CHAPTER 9e

Telemetry Attributes Transfer Standard

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Acronyms

API	application programming interface
ARINC	Aeronautical Radio, Incorporated
ASCII	American Standard Code for Information Interchange
CR	carriage return
dB	decibel
DDML	Data Display Markup Language
FFI	frame format identification
FM	frequency modulation
HTML	hypertext markup language
Hz	hertz
IAW	in accordance with
IHAL	Instrumentation Hardware Abstraction Language
iNET	integrated Network Enhanced Telemetry
kHz	kilohertz
LF	line feed
lsb	least significant bit
MDL	Metadata Description Language
MHz	megahertz
MIL-STD	Military Standard
msb	most significant bit
ODBC	open database connectivity
PCM	pulse code modulation
PM	phase modulation
RF	radio frequency
SST	serial streaming telemetry
SVG	Scalable Vector Graphics
TMATS	Telemetry Attributes Transfer Standard
TmNS	Telemetry Network Standard
W3C	World Wide Web Consortium
XidML	eXtensible Instrumentation Definition Markup Language
XML	eXtensible Markup Language
XSD	XML schema document

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CHAPTER 9

Telemetry Attributes Transfer Standard

9.1 General

Telemetry attributes are those parameters required by the receiving/processing system to acquire, process, and display the telemetry data received from the test item/source. The telemetry attributes defined in this chapter provide the information required to set up the telemetry receiving and processing equipment. The format, while not necessarily compatible with any receiving/processing system, will allow test ranges or other receiving systems to develop a computer conversion program to extract the information and to set up data required for their unique equipment configuration.

The intent of this chapter is to cover, primarily, attributes and terminology included in or consistent with the other chapters within this telemetry standards document. For example, pulse code modulation (PCM) format attributes should comply with the PCM standards as given in Chapter 4. Other attributes are sometimes included for service and utility, but should not be construed as endorsements apart from the other chapters.

9.2 Scope

The Telemetry Attributes Transfer Standard (TMATS) provides the definition of the telemetry attributes and specifies the media and data format necessary to permit the transfer of the information required to set up the telemetry receiving/processing functions at a test range. The standard does not conform to, nor does it define, existing or planned capabilities of any given test range. The parameters included in this document are defined by specific reference. Other nonstandard parameter values/ definitions may be included in the comments section of each group.

9.3 Purpose

The TMATS provides a common format for the transfer of information between the user and a test range or between ranges (see Appendix 9-A). This format will minimize the "station-unique" activities that are necessary to support any test item. In addition, TMATS is intended to relieve the labor-intensive process required to reformat the information by providing the information on computer-compatible media, thereby reducing errors and requiring less preparation time for test support.

9.4 Media and Data Structure

A variety of physical and electronic media is available for use in exchanging attribute information. The most important factor in selecting a medium is that the parties involved agree to use that specific medium. If any data compression (such as backup/restore or zip/unzip) will be used, both parties should agree to its use.

A cover sheet describing the system that produced the attribute medium should accompany the attribute information. A recommended format for the cover sheet is given in Appendix 9-B.

9.4.1 Physical Format

Attributes for each mission configuration are to be supplied in a single physical file with contents as 7-bit American Standard Code for Information Interchange (ASCII) coded characters. Line feed (LF) and carriage return (CR) may be used to improve readability of the information. Nonprintable characters will be discarded by the destination agency prior to translating the attributes into telemetry system configuration information.

Multiple mission configurations may be provided on a single disk; however, each configuration must be in a separate file identified in the disk directory. File names should use the file extensions ".TXT" to indicate a text file or ".TMT" or ".TMA" to indicate a TMATS file. A stick-on label and the accompanying cover sheet identify the file names corresponding to the mission configuration used for each mission.

9.4.2 Logical Format

Each attribute appears in the file as a unique code name and as a data item. The code name appears first, delimited by a colon. The data item follows, delimited by a semicolon. Thus, an attribute is formatted as A:B; - where A is the code name and B is the data item, in accordance with (IAW) the tables in Section 9.5. Numeric values for data items may be either integer or decimal. Scientific notation (see note below) is allowed only for the specific data items defined for its use in the tables in Section 9.5. For alphanumeric data items, including keywords, either upper or lower case is allowed; TMATS is not case sensitive. All defined keyword values are shown as upper case and enclosed in quotes in the tables in Section 9.5. Leading, trailing, and embedded blanks are assumed to be intentional; they can be ignored in most cases but should not be used in code names, keywords, and data items used as links, such as measurement name. Semicolons are not allowed in any data item (including comment items). Any number of attributes may be supplied within a physical record. Attributes may appear in any order.

CHANGE

NOTE	Any numeric data item expressed in scientific notation must conform to the following regular expression: ([-+]?(([0-9]+\.?[0-9]*)|([0-9]*\.[0-9]+)))([eE][-+]?[0-9]{1,3}) This expression limits the number of digits in the exponent to three or less, but allows any number of digits (including none) both before and after the decimal point in the fraction. Also, the decimal point can be omitted (for example, "3E5" is valid).

The two basic types of attribute code names are single-entry and multiple-entry. Single-entry attributes are those for which there is only one data item. Multiple-entry attributes appear once in the definition tables in Section 9.5 but have multiple items; these items are assigned a number. The number appears in the code name preceded by a hyphen. For example, data source identifiers might have the following entries:

G\DSI-1:Aircraft;

G\DSI-2:Missile;

G\DSI-3:Target;

The code name COMMENT may be used to interject comments to improve readability. The comment data items, such as G\COM, are intended to convey further details within the TMATS file itself. Comments must follow the attribute logical format, as shown below:

COMMENT: This is an example of a comment;

Refer to Section 9.5 for detailed definitions of code names and attributes and Appendix 9-C for an example application of this standard.

	It is recommended that data source/link names and measurement names consist of only the following: • Capitalized alphabetic characters • Numeric characters • The underscore symbol ("_") Specifically, it is recommended to avoid the use of embedded spaces and other special characters in data source/link names and measurement names.

9.4.3 Extensible Markup Language Format

In addition to the code name format described in Subsection 9.4.2, TMATS attributes can also be expressed in extensible markup language (XML). The TMATS XML format is implemented as a standard XML schema consisting of a collection of XML schema document (XSD) files, which can be found here. Additionally, a graphical depiction of the schema in HTML format is available here. The HTML files are very large and will take time to download.

The TMATS XML schema is identical in content to the telemetry attributes described in Section 9.5 below, with the exceptions shown in the following list.

a. There is a C group for each data link instead of only one C group in the TMATS file.

b. The schema has no counter ("\N") attributes; they are not needed in XML.

c. Keyword attribute values are expanded for readability in the schema.

d. Date and time formats are different; the schema uses the XML standard date and time formats (not the ones in Section 9.5).

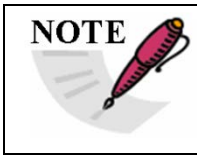
e. Text entries in the XML schema may contain semicolons; the code name format uses the semicolon as a delimiter.

f. The inherent structure of an XML schema implies order, while the code name format allows the attributes to be given in any order.

In addition to the TMATS XML schema, there are two other XML schemas that describe related areas of information. The first one, Data Display Markup Language (DDML), covers commonly used types of data displays. Refer to Section 9.6 for a full description of this standard format for data display definitions. The other one, Instrumentation Hardware Abstraction Language (IHAL), deals with the instrumentation hardware configuration on a test item. See Section 9.7 for a full description of this standard format for describing instrumentation hardware.

9.5 Telemetry Attributes

The description of the mission configuration includes all potential sources of data; these sources are radio frequency (RF) links, pre- or post-detected tapes, and onboard recorded tapes and storage media. Each of these data sources has unique characteristics that must be defined. Each source is given a unique identity and its characteristics are specifically defined in associated attribute fields. In multiplexed systems, each data stream is uniquely identified by a data link name, which is related to the data source name.

	Only the information that is essential to define the attributes of a system is required. Non-applicable information does not need to be included in the file; however, all attribute information given is to be provided in the specified format.

The attributes defined in this section proceed from the general level to the detailed level. The groups, defined in terms of data to be entered, are:

a. General Information: Establishes the top-level program definition and identifies the data sources.

b. Transmission Attributes: Defines an RF link. There will be one group for each RF link identified in the General Information group.

c. Recorder-Reproducer Attributes: Identifies a tape or storage data source.

d. Multiplex/Modulation Attributes: Describes the FM/FM (frequency modulation), FM/PM (phase modulation), or PM/PM multiplex characteristics. Each multiplexed waveform must have a unique set of attributes. For the analog measurement, the tie to the engineering units conversion is made in this group.

e. Digital Data Attributes: Divided into four groups: the PCM Format Attributes, the PCM Measurement Description, the Bus Data Attributes, and the Message Data Attributes.

   (1) PCM Format Attributes: Defines the PCM data format characteristics, including embedded formats. Each PCM format will have a separate format attributes group.

   (2) PCM Measurement Descriptions: Defines each PCM measurement within the overall PCM format.

   (3) Bus Data Attributes: Specifies the PCM-encoded Military Standard (MIL-STD) 1553 or Aeronautical Radio, Incorporated (ARINC) 429 bus format characteristics or the direct recorder track/channel MIL-STD-1553 or ARINC 429 bus format characteristics.

   (4) Message Data Attributes: Specifies the message-based data streams.

f. Pulse Amplitude Modulation Attributes: As of RCC IRIG 106-13, this section has been removed. See Annex A.1 for applicable Pulse Amplitude Modulation data standards.

g. Data Conversion Attributes: Contains the data conversion information for all measurements in this telemetry system. The calibration data and conversion definition of raw telemetry data to engineering units is included. The tie to the measurands of the telemetry systems defined in the previous groups is via the measurement name.

h. Airborne Hardware Attributes: Defines the configuration of airborne instrumentation hardware in use on the test item.

i. Vendor-Specific Attributes: Provides information that is specific to a vendor.

9.5.1 Contents

The following subparagraphs discuss the organization of the attributes and their relationships with the various groups.

a. Organization. Attribute information is organized according to a hierarchical structure in which related items are grouped and given a common heading. The number of levels varies within the overall structure and is a function of the logical association of the attributes. At the highest level, the telemetry attributes are defined for the groups displayed in Table 9-1.

Table 9-1. Telemetry Attribute Groups

Identifier	Title
G	General Information
T	Transmission Attributes
R	Recorder-Reproducer Attributes
M	Multiplex/Modulation Attributes
P	PCM Format Attributes
D	PCM Measurement Description
B	Bus Data Attributes
S	Message Data Attributes
C	Data Conversion Attributes
H	Airborne Hardware Attributes
V	Vendor-Specific Attributes
X	TMATS eXtension Attributes

Within the structure, a lower-case letter, for example, n, p, or r, indicates a multiple-entry item with the index being the lower-case letter. The range of these counters is from one to the number indicated in another data entry, usually with the appendage \N, and have no missing values.

The Usage Attributes column within each table describes how a particular attribute is to be used, when it is allowed, etc. If there are enumerations for the attribute, the enumeration values and their descriptions will appear in this column. There are 7 possible fields within this column for each attribute.

- R/R Ch 10 Status: This describes special rules for creating TMATS files to support setup of a Chapter 10 recorder. A value of “R” requires that the attribute be specified in the TMATS file whenever the attribute is allowed. A value of “RO” indicates that when an applicable data type or group is used, the attribute must be specified in the TMATS file. A value of “RO-PAK” indicates the attribute must be specified when the Data Packing Option (R-x\PDP-n) is either UNPACKED (UN) or PACKED (PFS). If the attribute is specified in the TMATS file, it must contain valid information.

- Allowed when: This describes when an attribute is allowed to be specified inside of a TMATS file.
- Required when: This describes when an attribute must be specified inside of a TMATS file. If the Required condition is "When Allowed", then it must be specified when the "Allowed when" condition is met.
- Links to: Specifies a list of attributes that the attribute links to by value.
- Links from: Specifies a list of attributes that link to this attribute by value. Any attribute with a Links from: is a key and must be unique in the TMATS file.
- Range: This describes the values or ranges that may be specified. A range might be specified with exact values or may reference the value of another TMATS attribute. The range may also be simply a number of characters that represents the recommended maximum length of the value. Where possible, the valid ranges for numbers are specified, however each range should be consulted as to their specific capabilities There are several special values for Range:
    - Enumeration: This specifies that the value must be one of the values listed in the description column of the attribute. The enumerations will follow.
    - Floating Point: This specifies a legal floating point, integer, or scientific notation value.
    - xxx.xxx.xxx.xxx: This specifies an Internet Protocol (IP) address where each "xxx" is a value from 0-255.
    - Hexadecimal: A numeric value base 16 containing 0-9 and A-F or a-f.
    - Binary: A numeric value base 2 containing 0-1
    - Binary pattern: A binary numeric pattern consisting of 0, 1, or "X" for don't care.
    - "X": the character "X"
    - MM-DD-YYYY-HH-MI-SS: This specifies a date and time. MM is the month from 01 to 12. DD is the day of the month from 01 to 31. YYYY is the 4 digit year. HH is the hour of the day from 00 to 23. MI is the minute of the hour from 00 to 59. SS is the second from 00 to 59.
- Default: This identifies the default value required to process a TMATS file when the file itself does not contain the attribute.

	In previous versions of this document, there existed code name tags *R-CH10*, *RO-CH10* and *RO-CH10-PAK*. These have been removed in favor of the above attribute column. If the R/R Ch10 Status field is "R", then the attribute must be included in the TMATS file if all other conditions apply even if it has a default.

b. Group Relationships. Representative interrelationships between the various groups are shown pictorially in Figure 9-1. Not all valid paths are shown. All valid paths are documented in "Links to:" and "Links from:" attributes.

	a. Data Source ID is unique within a General Information group (G). It ties the Transmission group (T) or the Recorder-Reproducer group (R) or both to the G group and to the Multiplex/Modulation group (M). b. The tie from the M group to a PCM group (P) is the Data Link Name. c. The tie from the P group to an embedded P group is another Data Link Name. d. The tie from the M group to the Data Conversion group (C) for an analog measurement is the Measurement Name. e. The tie from the P group to the PCM Measurement Description group (D) or Bus group (B) is the Data Link Name. f. The tie from the R group to the P group is from the Channel Data Link Name (R) to the Data Link Name (P). g. The tie from the R group to the B group is from the Channel Data Link Name or Sub-Channel Name (R) to the Data Link Name (B). h. The tie from the R group to the Message Data group (S) is from the Channel Data Link Name, Sub-Channel Name, or Network Name (R) to the Data Link Name (S). i. The tie from either the R, D, B, or S group to the Data Conversion group is the Measurement Name.

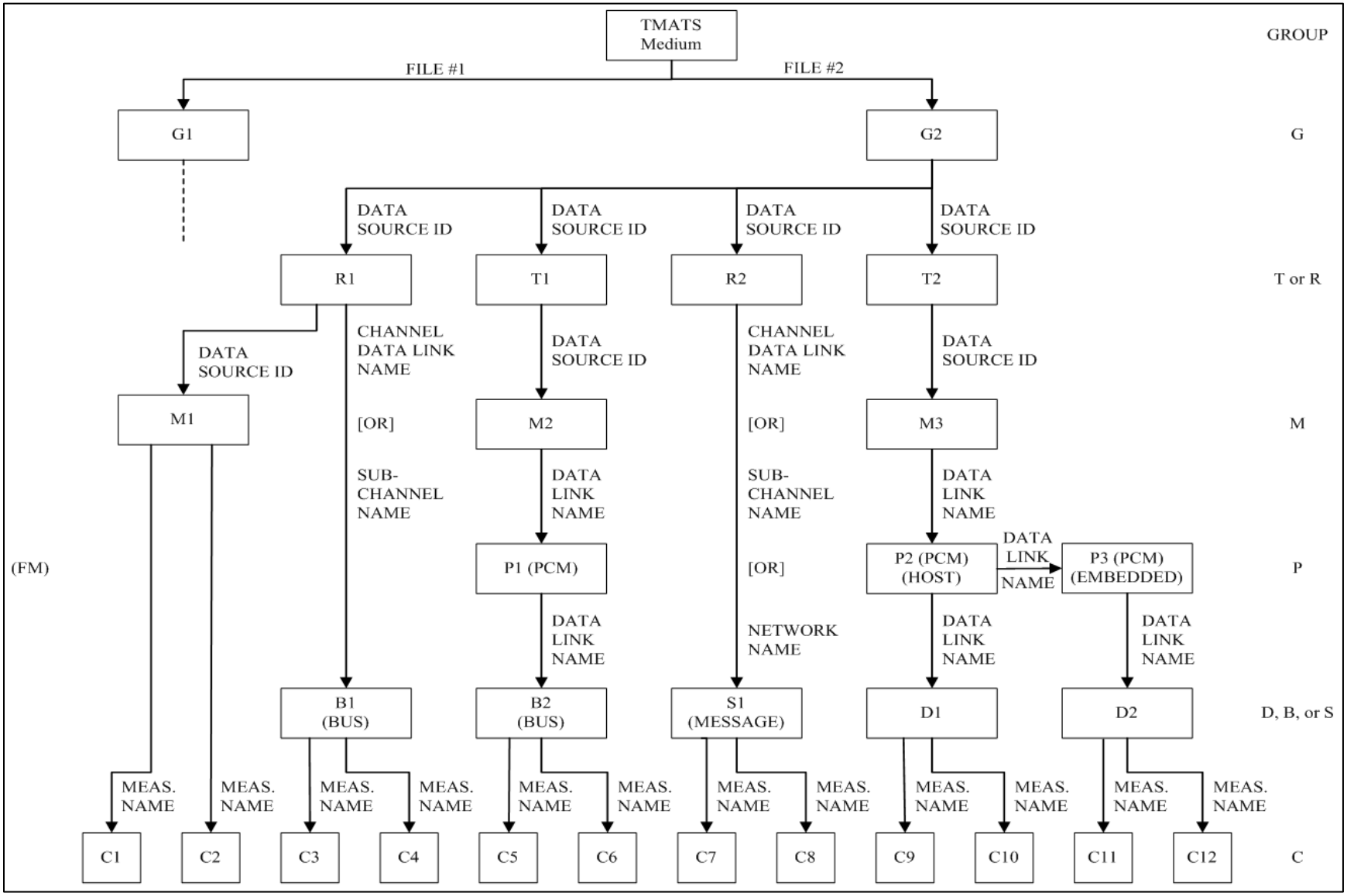


Figure 9-1. Group Relationships

9.5.2 General Information (G)

The General Information group provides overall program information. Figure 9-2 below gives the overall information that is included in this group. Table 9-2 identifies and defines the data required, including the dates associated with the detailed information. Since the identification of the data sources is an integral part of the remaining groups, each source must be uniquely identified.

Figure 9-2. General Information Group (G)				Code Name
PROGRAM NAME - 9-10				(G\PN)
9-10	TEST ITEM			(G\TA)
	***Information**			
		TMATS FILE NAME		(G\FN)
		RCC IRIG 106 REVISION LEVEL		(G\106)
		ORIGINATION DATE		(G\OD)
		REVISION NUMBER		(G\RN)
		REVISION DATE		(G\RD)
		UPDATE NUMBER		(G\UN)
		UPDATE DATE		(G\UD)
		TEST NUMBER		(G\TN)
		NUMBER OF POINTS OF CONTACT		(G\POC\N)
9-11		***Point of Contact**		
			NAME	(G\POC1-n)
			AGENCY	(G\POC2-n)
			ADDRESS	(G\POC3-n)
			TELEPHONE	(G\POC4-n)
9-11	***Data Source Identification**			
		NUMBER OF DATA SOURCES		(G\DSI\N)
			DATA SOURCE ID	(G\DSI-n)
			DATA SOURCE TYPE	(G\DST-n)
			DATA SOURCE SECURITY CLASSIFICATION	(G\DSC-n)
9-12	***Test Information**			
		TEST DURATION		(G\TI1)
		PRE-TEST REQUIREMENT		(G\TI2)
		POST-TEST REQUIREMENT		(G\TI3)
		SECURITY CLASSIFICATION		(G\SC)
9-13	***TMATS Checksum**			
		MESSAGE DIGEST/CHECKSUM		(G\SHA)
9-13	*** Comments**			
		COMMENTS		(G\COM)
*Heading Only - No Data Entry				

Table 9-2. General Information Group (G)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
PROGRAM NAME	G\PN	Allowed when: Always Range: 16 characters	Name of program.
TEST ITEM	G\TA	Allowed when: Always Range: 64 characters	Test item description in terms of name, model, platform, or identification code, as appropriate.
Information			
TMATS FILE NAME	G\FN	Allowed when: Always Range: 256 characters	Name of this TMATS file.
RCC IRIG 106 REVISION LEVEL	G\106	R/R Ch 10 Status: R Allowed when: Always Required when: Always Range: 0-99	Version of RCC IRIG 106 standard used to generate this TMATS file. The last 2 digits of the year should be used. Use a leading 0 if necessary.
ORIGINATION DATE	G\OD	Allowed when: Always Range: MM-DD-YYYY	Date of origination of this mission configuration. “DD” (Day). “MM” (Month). “YYYY” (Year).
REVISION NUMBER	G\RN	Allowed when: Always Range: 0-9999	Revision number associated with this mission configuration.
REVISION DATE	G\RD	Allowed when: Always Range: MM-DD-YYYY	Date of revision. “DD” (Day). “MM” (Month). “YYYY” (Year).
UPDATE NUMBER	G\UN	Allowed when: Always Range: 0-99	Update number of current change that has not been incorporated as a revision.
UPDATE DATE	G\UD	Allowed when: Always Range: MM-DD-YYYY	Date of update. “DD” (Day). “MM” (Month). “YYYY” (Year).
TEST NUMBER	G\TN	Allowed when: Always Range: 16 characters	Test identification.
NUMBER OF POINTS OF CONTACT	G\POC\N	Allowed when: Always Range: 0-9 Default: 0	Number of points of contact to be given.

Table 9-2. General Information Group (G)

Parameter	Code Name	Usage Attributes	Definition
Point of Contact			
NAME	G\POC1-n	Allowed when: G\POC\N > 0 Range: 24 characters	Identify the name point of contact for additional information.
AGENCY	G\POC2-n	Allowed when: G\POC\N > 0 Range: 48 characters	Identify the agency point of contact for additional information.
ADDRESS	G\POC3-n	Allowed when: G\POC\N > 0 Range: 48 characters	Identify the address point of contact for additional information.
TELEPHONE	G\POC4-n	Allowed when: G\POC\N > 0 Range: 20 characters	Identify the telephone point of contact for additional information.
Data Source Identification			
NUMBER OF DATA SOURCES	G\DSI\N	R/R Ch 10 Status: R Allowed when: Always Required when: Allowed Range: 1-99	Specify the number of data sources: for RF telemetry systems, give the number of carriers; for tape or storage recorded data, identify the number of tape or storage sources.
DATA SOURCE ID	G\DSI-n	R/R Ch 10 Status: R Allowed when: G\DSI\N > 0 Required when: Allowed Links to: R-x\ID, T-x\ID, M-x\ID, V-x\ID Range: 32 characters	Provide a descriptive name for this source. Each source identifier must be unique.
DATA SOURCE TYPE	G\DST-n	R/R Ch 10 Status: R Allowed when: G\DSI\N > 0 Required when: Allowed Range: Enumeration	Specify the type of source.

Enumeration	Description
RF	Radio Frequency
TAP	Tape
STO	Storage
REP	Reproducer
DSS	Distributed source

Table 9-2. General Information Group (G)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		DRS	Direct source	
		OTH	Other	
DATA SOURCE SECURITY CLASSIFICATION (CHANGE)	G\DSC-n	Allowed when: G\DSI\N > 0		Provide the classification of the data for this source. Provide a description of the classification guide and any information concerning declassification and/or downgrading in comments. For Digital Recorder Data Sources, this specifies the classification and distribution statements of the data file produced by the Recorder.
		Range: 2048 Characters		
NOTE: Provide the above three items for each data source.				
Test Information				
TEST DURATION	G\TI1	Allowed when: Always		Approximate duration of test in hours.
		Range: 0-9999		
PRE-TEST REQUIREMENT	G\TI2	Allowed when: Always		Indicate whether a pre-test requirement is applicable. Provide details in comments.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
POST-TEST REQUIREMENT	G\TI3	Allowed when: Always		Specify whether a post-test requirement is applicable. Provide details in comments.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
SECURITY CLASSIFICATION (CHANGE)	G\SC	Allowed when: Always		Provide the classification of the TMATS file. Provide a description of the classification guide and any information concerning declassification and/or downgrading in comments.
		Range: 2048 Characters		

Table 9-2. General Information Group (G)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
TMATS Checksum			
MESSAGE DIGEST/ CHECKSUM	G\SHA	Allowed when: Always Range: integer followed by "-" followed by hex characters	Provide a message digest / checksum of the TMATS. The entire contents of the TMATS file except the characters from "G\SHA:" to the following ";" (inclusive) shall be used to calculate the checksum. The value integer is an algorithm designator and the hex digits are the checksum. SHA2-256 shall be represented as "2-" followed by 64 hex characters. See Subsection 6.2.2.40 for more information.
Comments			
COMMENTS	G\COM	Allowed when: Always Range: 1600 characters	Provide the additional information requested or any other information desired.

9.5.3 Transmission Attributes (T)

The Transmission attributes are presented graphically in Figure 9-3 and specified in Table 9-3. The information contained within this group is used to set up the RF receiver through the detection and recovery of the baseband composite waveform. The format contains the information needed to configure the antenna and receiver subsystems.

Additional equipment inserted in a specific range configuration, such as microwave or other relay, is intended to be transparent to the user and is not described under Transmission Attributes.

Because the information is mutually exclusive, only the appropriate FM or PM system data set is required for a link.

	Figure 9-3. Transmission Attributes Group (T)	Code Name
DATA SOURCE ID - 9-16		(T-x\ID)
	*__Source RF Attributes__	
	TRANSMITTER ID	(T-x\TID)
	FREQUENCY	(T-x\RF1)
	RF BANDWIDTH	(T-x\RF2)
	DATA BANDWIDTH	(T-x\RF3)
	MODULATION TYPE	(T-x\RF4)
	TOTAL CARRIER MODULATION	(T-x\RF5)
	POWER (RADIATED)	(T-x\RF6)
9-17	NUMBER OF SUBCARRIERS	(T-x\SCO\N)
9-17	SUBCARRIER NUMBER	(T-x\SCO1-n)
	MODULATION INDEX	(T-x\SCO2-n)
	MODULATOR NON-LINEARITY	(T-x\RF7)
9-17	*__Premodulation Filter__	
	BANDWIDTH	(T-x\PMF1)
	SLOPE	(T-x\PMF2)
	TYPE	(T-x\PMF3)
9-18	*__Transmit Antenna__	
	TRANSMIT ANTENNA TYPE	(T-x\AN1)
	TRANSMIT POLARIZATION	(T-x\AN2)
	ANTENNA LOCATION	(T-x\AN3)
9-18	*__Antenna Patterns__	
	DOCUMENT	(T-x\AP)
	*__Point of Contact__	
	NAME	(T-x\AP\POC1)
	AGENCY	(T-x\AP\POC2)
	ADDRESS	(T-x\AP\POC3)
	TELEPHONE	(T-x\AP\POC4)
9-18	*__Ground Station Attributes__	
	IF BANDWIDTH	(T-x\GST1)
	BASEBAND COMPOSITE BANDWIDTH	(T-x\GST2)
9-19	*__Gain Control__	

			AGC TIME CONSTANT	(T-x\GST3)
		OR	MGC GAIN SET POINT	(T-x\GST4)
		AFC/APC		(T-x\GST5)
			TRACKING BANDWIDTH	(T-x\GST6)
9-19		POLARIZATION RECEPTION		(T-x\GST7)
9-20		***FM Systems**		
			DISCRIMINATOR BANDWIDTH	(T-x\FM1)
			DISCRIMINATOR LINEARITY	(T-x\FM2)
9-20	OR	***PM Systems**		
			PHASE LOCK LOOP BANDWIDTH	(T-x\PLL)
	***Comments**			
9-20		COMMENTS		(T-x\COM)

*Heading Only - No Data Entry

Table 9-3. Transmission Attributes Group (T)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
DATA SOURCE ID	T-x\ID	Allowed when: Always	Data source ID consistent with General Information group.
		Required when: defining Transmitter attributes	
		Links from: G\DSI-n	
		Links to: M-x\ID	
		Range: 32 characters	
Source RF Attributes			
TRANSMITTER ID	T-x\TID	Allowed when: T-x\ID specified	Transmitter identification.
		Range: 12 characters	
FREQUENCY	T-x\RF1	Allowed when: T-x\ID specified	Carrier frequency, in megahertz (MHz). If programmable, enter "P" and define in comments.
		Range: 6 characters	
RF BANDWIDTH	T-x\RF2	Allowed when: T-x\ID specified	Total RF bandwidth (−60 decibel [dB]) of modulated signal, in MHz.
		Range: 6 characters	
DATA BANDWIDTH	T-x\RF3	Allowed when: T-x\ID specified	Composite baseband data bandwidth (3 dB), in kilohertz (kHz).
		Range: 6 characters	
MODULATION TYPE	T-x\RF4	Allowed when: T-x\ID specified	Define the modulation type.
		Range: Enumeration	
		Enumeration / Description	
		FM	
		PM	
		BPSK	
		DPSK	
		QPSK	
		FQPSK-B	
		FQPSK-JR	
		SOQPSK-TG	
		MULTI-H-CPM	
		OTHR	

Table 9-3. Transmission Attributes Group (T)

Parameter	Code Name	Usage Attributes		Definition
TOTAL CARRIER MODULATION	T-x\RF5	Allowed when: T-x\ID specified Range: 6 characters		For FM system, define total carrier deviation, peak-to-peak, in kHz. For PM system, define total phase modulation, peak-to-peak, in radians.
POWER (RADIATED)	T-x\RF6	Allowed when: T-x\ID specified Range: 4 characters		Total transmitted power when modulated, in watts.
NUMBER OF SUBCARRIERS	T-x\SCO\N	Allowed when: T-x\ID specified Range: 0-99, "NO" Default: NO		Number of subcarriers in the composite baseband waveform, n. If none, enter "NO".
SUBCARRIER NUMBER	T-x\SCO1-n	Allowed when: T-x\SCO\N > 0 Required when: Allowed Range: 5 characters		Give the IRIG channel number for the subcarrier. If nonstandard subcarrier, enter "NO" and enter frequency in the comments section where n is an identification tag for the subcarrier.
MODULATION INDEX	T-x\SCO2-n	Allowed when: T-x\SCO\N > 0 Range: 4 characters		Specify the modulation index for each subcarrier in the composite waveform, as appropriate.
MODULATOR NONLINEARITY	T-x\RF7	Allowed when: T-x\ID is specified Range: Floating point 0-100 Default: 0		Modulator nonlinearity, in percent.
Premodulation Filter				
BANDWIDTH	T-x\PMF1	Allowed when: T-x\ID is specified Range: 6 characters		Pre-modulation composite filter bandwidth, 3 dB cut-off frequency, in kHz.
SLOPE	T-x\PMF2	Allowed when: T-x\ID is specified Range: 2 characters		Pre-modulation filter asymptotic roll-off slope, dB/octave.
TYPE	T-x\PMF3	Allowed when: T-x\ID is specified Range: Enumeration		Specify the filter type.
		Enumeration	Description	
		CA	Constant amplitude	
		CD	Constant delay	
		OT	Other	

Table 9-3. Transmission Attributes Group (T)

Parameter	Code Name	Usage Attributes		Definition
Transmit Antenna				
TRANSMIT ANTENNA TYPE	T-x\AN1	Allowed when: T-x\ID is specified		Transmit antenna type.
		Range: 16 characters		
TRANSMIT POLARIZATION	T-x\AN2	Allowed when: T-x\ID is specified		Transmit antenna polarization.
		Range: Enumeration		
		Enumeration	Description	
		RHCP		
		LHCP		
		LIN	linear	
ANTENNA LOCATION	T-x\AN3	Allowed when: T-x\ID is specified		Describe the antenna location.
		Range: 16 characters		
Antenna Patterns				
DOCUMENT	T-x\AP	Allowed when: T-x\ID is specified		Identify document having antenna patterns.
		Range: 16 characters		
Point of Contact				
NAME	T-x\AP\POC1	Allowed when: T-x\ID is specified		Identify the name point of contact for additional information.
		Range: 24 characters		
AGENCY	T-x\AP\POC2	Allowed when: T-x\ID is specified		Identify the agency point of contact for additional information.
		Range: 48 characters		
ADDRESS	T-x\AP\POC3	Allowed when: T-x\ID is specified		Identify the address point of contact for additional information.
		Range: 48 characters		
TELEPHONE	T-x\AP\POC4	Allowed when: T-x\ID is specified		Identify the telephone point of contact for additional information.
		Range: 20 characters		
Ground Station Attributes				
IF BANDWIDTH	T-x\GST1	Allowed when: T-x\ID is specified		Define IF bandwidth (3 dB) in MHz.
		Range: 6 characters		
BASEBAND COMPOSITE BANDWIDTH	T-x\GST2	Allowed when: T-x\ID is specified		Define the cutoff frequency (3 dB), of the output filter, in kHz.
		Range: 6 characters		

Table 9-3. Transmission Attributes Group (T)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
Gain Control				
AGC TIME CONSTANT	T-x\GST3	Allowed when: T-x\ID is specified		Specify the AGC time constant desired in milliseconds.
		Range: 4 characters		
MGC GAIN SET POINT	T-x\GST4	Allowed when: T-x\ID is specified		Provide the manual gain control set point in terms of received signal strength, dBm.
		Range: 6 characters		
AFC/APC	T-x\GST5	Allowed when: T-x\ID is specified		Specify automatic frequency control, automatic phase control, or none.
		Range: Enumeration		
		Enumeration	Description	
		AFC	automatic frequency control	
		APC	automatic phase control	
		NON	none	
		Default: NON		
TRACKING BANDWIDTH	T-x\GST6	Allowed when: T-x\ID is specified		Specify tracking loop bandwidth, in hertz (Hz).
		Range: 4 characters		
POLARIZATION RECEPTION	T-x\GST7	Allowed when: T-x\ID is specified		Specify polarization to be used.
		Range: Enumeration		
		Enumeration	Description	
		RHCP		
		LHCP		
		BOTH		
		Both with diversity combining:		
		B&DPR	Pre-detection	
		B&DPO	Post-detection	
		Diversity combining only:		
		PRE-D	Pre-detection	
		POS-D	Post-detection	
		OTHER	Specify in comments	

Table 9-3. Transmission Attributes Group (T)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
FM Systems			
DISCRIMINATOR BANDWIDTH	T-x\FM1	Allowed when: T-x\ID is specified Range: 4 characters	Specify the discriminator bandwidth required, in MHz.
DISCRIMINATOR LINEARITY	T-x\FM2	Allowed when: T-x\ID is specified Range: 4 characters	Specify the required linearity over the bandwidth specified.
PM Systems			
PHASE LOCK LOOP BANDWIDTH	T-x\PLL	Allowed when: T-x\ID is specified Range: 4 characters	Specify the phase-locked loop bandwidth.
Comments			
COMMENTS	T-x\COM	Allowed when: T\ID is specified Range: 1600	Provide the additional information requested or any other information desired.

9.5.4 Recorder-Reproducer Attributes (R)

This group describes the attributes required when the data source is a magnetic tape as specified in Annex A.2 or a data storage device as specified in Chapter 10. In the case of the tape data link identification, each data source must be identified. In some cases, the data source identification may be identical, particularly when the same information has been received from different receiver sites, on different polarizations, or on different carriers for redundancy purposes. Some of the information requested will be available only from the recording site or the dubbing location.

Figure 9-4 indicates the information required. Various categories of information have been included. In the data section of the attributes, it will be necessary to repeat the items until all of the data sources, including the multiple tracks, have been defined that contain ground station data of interest. Table 9-4 defines the information required. Any nonstandard tape recordings will require explanation in the comments and may require supplemental definition.

Recorder-reproducer filtering and post-process data filtering and overwrite will use TMATS attributes to describe the requirements. Recorder-reproducer channel types that support filtering and overwrite will define these attributes. The PCM channels will use R, P, and D attributes and the bus channels will use R and B attributes to define filtering and overwrite definitions.

Figure 9-4. Recorder-Reproducer Attributes Group (R)				Code Name
DATA SOURCE ID - 9-30				(R-x\ID)
9-30	RECORDER-REPRODUCER ID			(R-x\RID)
	RECORDER-REPRODUCER DESCRIPTION			(R-x\R1)
9-30	***Recorder-Reproducer Media Characteristics**			
		RECORDER-REPRODUCER MEDIA TYPE		(R-x\TC1)
		RECORDER-REPRODUCER MEDIA MFG		(R-x\TC2)
		RECORDER-REPRODUCER MEDIA CODE		(R-x\TC3)
		RECORDER-REPRODUCER MEDIA LOCATION		(R-x\RML)
		EXTERNAL RMM BUS SPEED		(R-x\ERBS)
		TAPE WIDTH		(R-x\TC4)
		TAPE HOUSING		(R-x\TC5)
		TYPE OF TRACKS		(R-x\TT)
		NUMBER OF TRACKS/CHANNELS		(R-x\N)
		RECORD SPEED		(R-x\TC6)
		DATA PACKING DENSITY		(R-x\TC7)
		TAPE REWOUND		(R-x\TC8)
		NUMBER OF SOURCE BITS		(R-x\NSB)
9-33	***Recorder-Reproducer Information**			
		RECORDER-REPRODUCER MANUFACTURER		(R-x\RI1)
		RECORDER-REPRODUCER MODEL		(R-x\RI2)
		ORIGINAL RECORDING		(R-x\RI3)
		ORIGINAL RECORDING DATE AND TIME		(R-x\RI4)
9-33		***Creating Organization Point of Contact**		
			NAME	(R-x\POC1)

		AGENCY	(R-x\POC2)
		ADDRESS	(R-x\POC3)
		TELEPHONE	(R-x\POC4)
	DATE AND TIME OF COPY		(R-x\RI5)
9-34	***Copying Organization Point of Contact**		
		NAME	(R-x\DPOC1)
		AGENCY	(R-x\DPOC2)
		ADDRESS	(R-x\DPOC3)
		TELEPHONE	(R-x\DPOC4)
	POST PROCESS MODIFIED RECORDING		(R-x\RI6)
	POST PROCESS MODIFICATION TYPE		(R-x\RI7)
	DATE AND TIME OF MODIFICATION		(R-x\RI8)
	***Modifying Organization Point of Contact**		
		NAME	(R-x\MPOC1)
		AGENCY	(R-x\MPOC2)
		ADDRESS	(R-x\MPOC3)
		TELEPHONE	(R-x\MPOC4)
	CONTINUOUS RECORDING ENABLED		(R-x\CRE)
	RECORDER-REPRODUCER SETUP SOURCE		(R-x\RSS)
	RECORDER SERIAL NUMBER		(R-x\RI9)
	RECORDER FIRMWARE REVISION		(R-x\RI10)
	NUMBER OF MODULES		(R-x\RIM\N)
		MODULE ID	(R-x\RIMI-n)
		MODULE SERIAL NUMBER	(R-x\RIMS-n)
		MODULE FIRMWARE REVISION	(R-x\RIMF-n)
	NUMBER OF RMMS		(R-x\RMM\N)
		RMM IDENTIFIER	(R-x\RMMID-n)
		RMM SERIAL NUMBER	(R-x\RMMS-n)
		RMM FIRMWARE REVISION	(R-x\RMMF-n)
	*** Recorder-Reproducer Ethernet Interfaces**		
		NUMBER OF ETHERNET INTERFACES	(R-x\EI\N)
		ETHERNET INTERFACE NAME	(R-x\EINM-n)
NEW		PHYSICAL ETHERNET INTERFACE	(R-x\PEIN-n)
		ETHERNET INTERFACE LINK SPEED	(R-x\EILS-n)
		ETHERNET INTERFACE TYPE	(R-x\EIT-n)
		ETHERNET INTERFACE IP ADDRESS	(R-x\EIIP-n)
		NUMBER OF ETHERNET INTERFACE PORTS	(R-x\EIIP\N-n)
		PORT ADDRESS	(R-x\EI\PA-n-m)
		PORT TYPE	(R-x\EI\PT-n-m)
	*** Recorder-Reproducer Channel Group Streams**		
		NUMBER OF CHANNEL GROUPS	(R-x\CG\N)
		CHANNEL GROUP NAME	(R-x\CGNM-n)
		CHANNEL GROUP STREAM NUMBER	(R-x\CGSN-n)
		NUMBER OF GROUP CHANNELS	(R-x\CGCH\N-n)

			GROUP CHANNEL NUMBER	(R-x\CGCN-n-m)
		*** Recorder-Reproducer Drives and Volumes**		
			NUMBER OF DRIVES	(R-x\DR\N)
			DRIVE NAME	(R-x\DRNM-n)
			DRIVE NUMBER	(R-x\DRN-n)
			DRIVE BLOCK SIZE	(R-x\DRBS-n)
			NUMBER OF DRIVE VOLUMES	(R-x\DRVL\N-n)
			VOLUME NAME	(R-x\VLNM-n-m)
			VOLUME NUMBER	(R-x\VLN-n-m)
			VOLUME BLOCKS TO ALLOCATE	(R-x\VLBA-n-m)
			VOLUME NUMBER OF BLOCKS	(R-x\VLNB-n-m)
		*** Recorder-Reproducer Stream/Drive-Volume Links**		
			NUMBER OF LINKS	(R-x\L\N)
			LINK NAME	(R-x\LNM-n)
			LINK SOURCE STREAM NAME	(R-x\LSNM-n)
			LINK SOURCE STREAM NUMBER	(R-x\LSSN-n)
			LINK DESTINATION DRIVE NUMBER	(R-x\LDDN-n)
			LINK DESTINATION VOLUME NUMBER	(R-x\LDVN-n)
NEW		*** Recorder-Reproducer Ethernet Interface Publishing Links**		
			NUMBER OF ETHERNET PUBLISHING LINKS	(R-x\EPL\N)
			LINK NAME	(R-x\EPL\LNM-n)
			LINK SOURCE STREAM NAME	(R-x\EPL\LSNM-n)
			LINK SOURCE STREAM NUMBER	(R-x\EPL\LSSN-n)
			LINK DESTINATION ETHERNET INTERFACE IP ADDRESS	(R-x\EPL\LDEIP-n)
			LINK DESTINATION ETHERNET INTERFACE PORT ADDRESS	(R-x\EPL\LDEPA-n)
	*** Computer-Generated Data Packet, User-Defined Definition**			
		USER-DEFINED CHANNEL ID		(R-x\UD\TK1)
9-42	***Recording Event Definitions**			
		RECORDING EVENTS ENABLED		(R-x\EV\E)
		RECORDING EVENTS CHANNEL ID		(R-x\EV\TK1)
		NUMBER OF RECORDING EVENTS		(R-x\EV\N)
		RECORDER INTERNAL EVENTS ENABLED		(R-x\EV\IEE)
9-43		***Recording Event**		
			EVENT ID	(R-x\EV\ID-n)
			EVENT DESCRIPTION	(R-x\EV\D-n)
			EVENT DATA PROCESSING ENABLED	(R-x\EV\EDP-n)
			EVENT TYPE	(R-x\EV\T-n)
9-44			EVENT PRIORITY	(R-x\EV\P-n)
			EVENT CAPTURE MODE	(R-x\EV\CM-n)

			EVENT INITIAL CAPTURE	(R-x\EV\IC-n)
			RECORDING EVENT LIMIT COUNT	(R-x\EV\LC-n)
			EVENT TRIGGER MEASUREMENT SOURCE	(R-x\EV\MS-n)
			EVENT TRIGGER MEASUREMENT NAME	(R-x\EV\MN-n)
			EVENT PROCESSING MEASUREMENT DATA LINK NAME	(R-x\EV\DLN-n)
			NUMBER OF MEASUREMENTS TO PROCESS	(R-x\EV\PM\N-n)
			MEASUREMENT NAME TO PROCESS	(R-x\EV\PM\MN-n-m)
			PRE-EVENT PROCESSING DURATION	(R-x\EV\PM\PRE-n-m)
			POST-EVENT PROCESSING DURATION	(R-x\EV\PM\PST-n-m)
9-46	***Recording Index**			
		RECORDING INDEX ENABLED		(R-x\IDX\E)
		RECORDING INDEX CHANNEL ID		(R-x\IDX\TK1)
		RECORDING INDEX TYPE		(R-x\IDX\IT)
9-46		*** Time Index Type Attribute**		
			INDEX TIME VALUE	(R-x\IDX\ITV)
	OR	*** Count Index Type Attribute**		
			INDEX COUNT VALUE	(R-x\IDX\ICV)
9-47	***MIL-STD-1553 Recorder Control**			
		MESSAGE MONITOR RECORD CONTROL ENABLED		(R-x\MRC\E)
		CHANNEL ID NUMBER		(R-x\MRC\ID)
		MESSAGE RECORD CONTROL TYPE		(R-x\MRC\RCT)
		STOP-PAUSE COMMAND WORD		(R-x\MRC\SPM)
		START-RESUME COMMAND WORD		(R-x\MRC\SRM)
	***Data**			
		TRACK NUMBER/ CHANNEL ID		(R-x\TK1-n)
		RECORDING TECHNIQUE		(R-x\TK2-n)
		INPUT STREAM DERANDOMIZATION		(R-x\IDDR-n)
9-48		DATA SOURCE ID		(R-x\DSI-n)
9-48		DATA DIRECTION		(R-x\TK3-n)
		RECORDER PHYSICAL CHANNEL NUMBER		(R-x\TK4-n)
		CHANNEL ENABLE		(R-x\CHE-n)
		CHANNEL DATA TYPE		(R-x\CDT-n)
		CHANNEL DATA LINK NAME		(R-x\CDLN-n)
		SECONDARY HEADER TIME FORMAT		(R-x\SHTF-n)
		***Data Type Attributes**		
9-50			***PCM Data Type Attributes**	
			PCM DATA TYPE FORMAT	(R-x\PDTF-n)
			DATA PACKING OPTION	(R-x\PDP-n)
NEW			RECORDER POLARITY SETTING	(R-x\RPS-n)
			INPUT CLOCK EDGE	(R-x\ICE-n)
			INPUT SIGNAL TYPE	(R-x\IST-n)
			INPUT THRESHOLD	(R-x\ITH-n)

		INPUT TERMINATION	(R-x\ITM-n)
		PCM VIDEO TYPE FORMAT	(R-x\PTF-n)
		PCM RECORDER-REPRODUCER MINOR FRAME FILTERING ENABLED	(R-x\MFF\E-n)
		PCM POST PROCESS OVERWRITE AND FILTERING ENABLED	(R-x\POF\E-n)
		PCM POST PROCESS OVERWRITE AND FILTERING TYPE	(R-x\POF\T-n)
		MINOR FRAME FILTERING DEFINITION TYPE	(R-x\MFF\FDT-n)
		NUMBER OF MINOR FRAME FILTERING DEFINITIONS	(R-x\MFF\N-n)
		FILTERED MINOR FRAME NUMBER	(R-x\MFF\MFN-n-m)
		NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	(R-x\SMF\N-n)
		SELECTED MEASUREMENT NAME	(R-x\SMF\SMN-n-m)
		MEASUREMENT OVERWRITE TAG	(R-x\SMF\MFOT-n-m)
9-55	OR	***MIL-STD-1553 Bus Data Type Attributes**	
		MIL-STD-1553 BUS DATA TYPE FORMAT	(R-x\BTF-n)
		MIL-STD-1553 RECORDER-REPRODUCER FILTERING ENABLED	(R-x\MRF\E-n)
		MIL-STD-1553 POST PROCESS OVERWRITE AND FILTERING ENABLED	(R-x\MOF\T-n)
		MIL-STD-1553 MESSAGE FILTERING DEFINITION TYPE	(R-x\MFD\FDT-n)
		NUMBER OF MESSAGE FILTERING DEFINITIONS	(R-x\MFD\N-n)
		MESSAGE NUMBER	(R-x\MFD\MID-n-m)
		MESSAGE TYPE	(R-x\MFD\MT-n-m)
		COMMAND WORD ENTRY	(R-x\CWE-n-m)
		COMMAND WORD	(R-x\CMD-n-m)
		REMOTE TERMINAL ADDRESS	(R-x\MFD\TRA-n-m)
		TRANSMIT/RECEIVE MODE	(R-x\MFD\TRM-n-m)
		SUBTERMINAL ADDRESS	(R-x\MFD\STA-n-m)
		DATA WORD COUNT/MODE CODE	(R-x\MFD\DWC-n-m)
		RECEIVE COMMAND WORD ENTRY	(R-x\RCWE-n-m)
		RECEIVE COMMAND WORD	(R-x\RCMD-n-m)
		RT/RT REMOTE TERMINAL ADDRESS	(R-x\MFD\RTRA-n-m)
		RT/RT SUBTERMINAL ADDRESS	(R-x\MFD\RSTA-n-m)
		RT/RT DATA WORD COUNT	(R-x\MFD\RDWC-n-m)

		NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	(R-x\BME\N-n)
		SELECTED MEASUREMENT NAME	(R-x\BME\SMN-n-m)
		MEASUREMENT OVERWRITE TAG	(R-x\BME\MFOT-n-m)
9-59	OR	***Analog Data Type Attributes**	
		ANALOG DATA TYPE FORMAT	(R-x\ATF-n)
		NUMBER OF ANALOG CHANNELS/PKT	(R-x\ACH\N-n)
		DATA PACKING OPTION	(R-x\ADP-n)
		SAMPLE RATE	(R-x\ASR-n)
		SUB CHANNEL ENABLED	(R-x\AMCE-n-m)
		NUMBER OF SUB CHANNEL ENABLED	(R-x\AMCN-n)
9-60		MEASUREMENT NAME	(R-x\AMN-n-m)
		DATA LENGTH	(R-x\ADL-n-m)
		BIT MASK	(R-x\AMSK-n-m)
		MEASUREMENT TRANSFER ORDER	(R-x\AMTO-n-m)
		SAMPLE FACTOR	(R-x\ASF-n-m)
		SAMPLE FILTER 3DB BANDWIDTH	(R-x\ASBW-n-m)
		AC/DC COUPLING	(R-x\ACP-n-m)
		RECORDER INPUT IMPEDANCE	(R-x\AII-n-m)
		INPUT CHANNEL GAIN	(R-x\AGI-n-m)
		INPUT FULL SCALE RANGE	(R-x\AFSI-n-m)
		INPUT OFFSET VOLTAGE	(R-x\AOVI-n-m)
		RECORDED ANALOG FORMAT	(R-x\AF-n-m)
		INPUT TYPE	(R-x\AIT-n-m)
		AUDIO	(R-x\AV-n-m)
		AUDIO FORMAT	(R-x\AVF-n-m)
9-63	OR	***Discrete Data Type Attributes**	
		DISCRETE DATA TYPE FORMAT	(R-x\DTF-n)
		DISCRETE MODE	(R-x\DMOD-n)
		SAMPLE RATE	(R-x\DSR-n)
		NUMBER OF DISCRETE MEASUREMENTS	(R-x\NDM\N-n)
		MEASUREMENT NAME	(R-x\DMN-n-m)
		BIT MASK	(R-x\DMSK-n-m)
		MEASUREMENT TRANSFER ORDER	(R-x\DMTO-n-m)
9-65	OR	***ARINC 429 Bus Data Type Attributes**	
		ARINC 429 BUS DATA TYPE FORMAT	(R-x\ABTF-n)
		NUMBER OF ARINC 429 SUB-CHANNELS	(R-x\NAS\N-n)
		ARINC 429 SUB-CHANNEL NUMBER	(R-x\ASN-n-m)
		ARINC 429 SUB-CHANNEL NAME	(R-x\ANM-n-m)
9-66	OR	***Video Data Type Attributes**	
		VIDEO DATA TYPE FORMAT	(R-x\VTF-n)
		MPEG-2 CHANNEL XON2 FORMAT	(R-x\VXF-n)

			VIDEO SIGNAL TYPE	(R-x\VST-n)
			VIDEO SIGNAL FORMAT TYPE	(R-x\VSF-n)
			VIDEO CONSTANT BIT RATE	(R-x\CBR-n)
			VIDEO VARIABLE PEAK BIT RATE	(R-x\VBR-n)
			VIDEO ENCODING DELAY	(R-x\VED-n)
			OVERLAY ENABLED	(R-x\VCO\OE-n)
			OVERLAY X POSITION	(R-x\VCO\X-n)
			OVERLAY Y POSITION	(R-x\VCO\Y-n)
			OVERLAY EVENT TOGGLE ENABLED	(R-x\VCO\OET-n)
			OVERLAY FORMAT	(R-x\VCO\OLF-n)
			OVERLAY BACKGROUND	(R-x\VCO\OBG-n)
			ANALOG AUDIO CHANNEL INPUT LEFT	(R-x\ASI\ASL-n)
			ANALOG AUDIO CHANNEL INPUT RIGHT	(R-x\ASI\ASR-n)
			VIDEO DATA ALIGNMENT	(R-x\VDA-n)
9-69	OR	***Time Data Type Attributes**		
			TIME DATA TYPE FORMAT	(R-x\TTF-n)
			TIME FORMAT	(R-x\TFMT-n)
			TIME SOURCE	(R-x\TSRC-n)
9-70	OR	***Image Data Type Attributes**		
			IMAGE DATA TYPE FORMAT	(R-x\ITF-n)
			STILL IMAGE TYPE	(R-x\SIT-n)
			DYNAMIC IMAGE FORMAT	(R-x\DIF-n)
			IMAGE TIME STAMP MODE	(R-x\ITSM-n)
			DYNAMIC IMAGE ACQUISITION MODE	(R-x\DIAM-n)
			IMAGE FRAME RATE	(R-x\IFR-n)
			PRE-TRIGGER FRAMES	(R-x\PTG-n)
			TOTAL FRAMES	(R-x\TOTF-n)
			EXPOSURE TIME	(R-x\EXP-n)
			SENSOR ROTATION	(R-x\ROT-n)
			SENSOR GAIN VALUE	(R-x\SGV-n)
			SENSOR AUTO GAIN	(R-x\SAG-n)
			SENSOR WIDTH	(R-x\ISW-n)
			SENSOR HEIGHT	(R-x\ISH-n)
			MAX IMAGE WIDTH	(R-x\MIW-n)
			MAX IMAGE HEIGHT	(R-x\MIH-n)
			IMAGE WIDTH	(R-x\IW-n)
			IMAGE HEIGHT	(R-x\IH-n)
			IMAGE OFFSET X	(R-x\IOX-n)
			IMAGE OFFSET Y	(R-x\IOY-n)
			LINE PITCH	(R-x\ILP-n)
			BINNING HORIZONTAL	(R-x\IBH-n)
			BINNING VERTICAL	(R-x\IBV-n)

			DECIMATION HORIZONTAL	(R-x\IDH-n)
			DECIMATION VERTICAL	(R-x\IDV-n)
			REVERSE X	(R-x\IRX-n)
			REVERSE Y	(R-x\IRY-n)
			PIXEL DYNAMIC RANGE MINIMUM	(R-x\IPMN-n)
			PIXEL DYNAMIC RANGE MAXIMUM	(R-x\IPMX-n)
			TEST IMAGE TYPE	(R-x\TIT-n)
9-75	OR	***UART Data Type Attributes**		
			UART DATA TYPE FORMAT	(R-x\UTF-n)
			NUMBER OF UART SUB-CHANNELS	(R-x\NUS\N-n)
			UART SUB-CHANNEL NUMBER	(R-x\USCN-n-m)
			UART SUB-CHANNEL NAME	(R-x\UCNM-n-m)
			UART SUB-CHANNEL BAUD RATE	(R-x\UCR-n-m)
			UART SUB-CHANNEL BITS PER WORD	(R-x\UCB-n-m)
			UART SUB-CHANNEL PARITY	(R-x\UCP-n-m)
			UART SUB-CHANNEL STOP BIT	(R-x\UCS-n-m)
			UART SUB-CHANNEL INTERFACE	(R-x\UCIN-n-m)
			UART SUB-CHANNEL BLOCK SIZE	(R-x\UCBS-n-m)
			UART SUB-CHANNEL SYNC WORD LENGTH	(R-x\UCSL-n-m)
			UART SUB-CHANNEL BLOCK SYNC VALUE	(R-x\UCSV-n-m)
			UART SUB-CHANNEL BLOCK RATE	(R-x\UCBR-n-m)
9-77	OR	***Message Data Type Attributes**		
			MESSAGE DATA TYPE FORMAT	(R-x\MTF-n)
			NUMBER OF MESSAGE SUB-CHANNELS	(R-x\NMS\N-n)
			MESSAGE SUB-CHANNEL NUMBER	(R-x\MSCN-n-m)
			MESSAGE SUB-CHANNEL NAME	(R-x\MCNM-n-m)
9-78	OR	***IEEE-1394 Data Type Attributes**		
			IEEE-1394 DATA TYPE FORMAT	(R-x\IETF-n)
9-78	OR	***Parallel Data Type Attributes**		
			PARALLEL DATA TYPE FORMAT	(R-x\PLTF-n)
9-78	OR	***Ethernet Data Type Attributes**		
			ETHERNET DATA TYPE FORMAT	(R-x\ENTF-n)
			NUMBER OF ETHERNET NETWORKS	(R-x\NNET\N-n)
			ETHERNET NETWORK NUMBER	(R-x\ENBR-n-m)
			ETHERNET NETWORK NAME	(R-x\ENAM-n-m)
9-79	OR	***TSPI/CTS Data Type Attributes**		
			TSPI/CTS DATA TYPE FORMAT	(R-x\TDTF-n)
	OR	***CAN Bus Data Type Attributes**		
			CAN BUS DATA TYPE FORMAT	(R-x\CBTF-n)
			NUMBER OF CAN BUS SUB-CHANNELS	(R-x\NCB\N-n)
			CAN BUS SUB-CHANNEL NUMBER	(R-x\CBN-n-m)

			CAN BUS SUB-CHANNEL NAME	(R-x\CBM-n-m)
			CAN BUS BIT RATE	(R-x\CBBS-n-m)
9-80	OR	***Fibre Channel Data Type Attributes**		
			FIBRE CHANNEL DATA TYPE FORMAT	(R-x\FCTF-n)
			FIBRE CHANNEL SPEED	(R-x\FCSP-n)
9-81	OR	***Telemetry Output Attributes**		
			OUTPUT STREAM NAME	(R-x\OSNM-n)
			STREAM ID	(R-x\SID-n)
			CONFIGURATION HASH RATE	(R-x\HRATE-n)
			CONFIGURATION PACKET RATE	(R-x\CRATE-n)
9-81	***Reference Track**			
		NUMBER OF REFERENCE TRACKS		(R-x\RT\N)
		TRACK NUMBER		(R-x\RT1-n)
		REFERENCE FREQUENCY		(R-x\RT2-n)
9-82	***Comments**			
		COMMENTS		(R-x\COM)

*Heading Only - No Data Entry

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
DATA SOURCE ID	R-x\ID	R/R Ch 10 Status: R		Data source ID consistent with General Information group.
		Allowed when: Always		
		Links from: G\DSI-n		
		Required when: defining a recorder		
		Range: 32 characters		
RECORDER-REPRODUCER ID	R-x\RID	R/R Ch 10 Status: R		Recorder-reproducer identification.
		Allowed when: R\ID is specified		
		Required when: Allowed		
		Range: 32 characters		
RECORDER-REPRODUCER DESCRIPTION	R-x\R1	Allowed when: R\ID is specified		Recorder-reproducer description.
		Range: 32 characters		
Recorder-Reproducer Media Characteristics				
RECORDER-REPRODUCER MEDIA TYPE	R-x\TC1	Allowed when: R\ID is specified		Specify the recorder-reproducer media type.
		Range: Enumeration		
		Enumeration	Description	
		ANAL	Analog	
		CASS	Cassette	
		HDDR	High Density Digital Recorder	
		PARA	Parallel	
		SSR	Solid State Recorder	
		MD	Magnetic Disk	
		N	None, Data Publishing Only	
		OTHR	Other, define in comments	
RECORDER-REPRODUCER MEDIA MANUFACTURER	R-x\TC2	Allowed when: R\TC1 is not “N”		Name of manufacturer of the recorder-reproducer media.
		Range: 8 characters		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
RECORDER-REPRODUCER MEDIA CODE	R-x\TC3	Allowed when: R\TC1 is not "N"		Specify manufacturer's recorder-reproducer media designation code.
		Range: 8 characters		
RECORDER-REPRODUCER MEDIA LOCATION	R-x\RML	R/R Ch 10 Status: R		Indicate the location of the recorder-reproducer media.
		Allowed when: R\TC1 is not "N"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		I	Internal	
		E	External	
		B	Both internal and external	
EXTERNAL RMM BUS SPEED	R-x\ERBS	R/R Ch 10 Status: RO		Indicate the speed of an external RMM IEEE-1394b bus.
		Allowed when: R\TC1 is not "N"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		AUTO	Speed set by host device	
		S100	100 Mbps	
		S200	200 Mbps	
		S400	400 Mbps	
		S800	800 Mbps	
		S1600	1600 Mbps	
		S3200	3200 Mbps	
TAPE WIDTH	R-x\TC4	Allowed when: R\TC1 is "ANAL" or "CASS"		Physical dimension of tape width, in inches.
		Range: 0.00 – 9.99		
TAPE HOUSING	R-x\TC5	Allowed when: R\TC1 is "ANAL" or "CASS"		State the reel size.
		Range: Enumeration		
		Enumeration	Description	
		10.5	10.5 Inches	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		14.0	14.0 Inches	
		15.0	15.0 Inches	
		16.0	16.0 Inches	
		12.65	12.65 Millimeters	
		19.0	19.0 Millimeters	
		OTHER	Other	
TYPE OF TRACKS	R-x\TT	Allowed when: R\TC1 is “ANAL” or “CASS”		State the type of tracks on the tape.
		Range: Enumeration		
		Enumeration	Description	
		LO	Longitudinal	
		RO	Rotary	
NUMBER OF TRACKS/ CHANNELS	R-x\N	R/R Ch 10 Status: R		State the number of tracks on the tape or the number of channels on the storage media.
		Allowed when: R\TC1 is not “N”		
		Required when: Allowed		
		Range: 1-65536		
RECORD SPEED	R-x\TC6	Allowed when: R\TC1 is “ANAL” or “CASS”		State record speed (inches/second).
		Range: 00.0 - 99.9		
DATA PACKING DENSITY	R-x\TC7	Allowed when: R\TC1 is “ANAL” or “CASS”		State recording system bandwidth.
		Range: Enumeration		
		Enumeration	Description	
		IM	Intermediate band	
		WB	Wide band	
		DD	Double density	
		OT	Other	
TAPE REWOUND	R-x\TC8	Allowed when: R\TC1 is “ANAL” or “CASS”		Name of tape rewound.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes	Definition
NUMBER OF SOURCE BITS	R-x\NSB	R/R Ch 10 Status: R Allowed when: R\ID is specified Range: 0 - 13	Number of most significant bits (msbs) of the channel ID used for multiplexer source ID. Specify 0 for one source.
Recorder-Reproducer Information			
RECORDER-REPRODUCER MANUFACTURER	R-x\RI1	Allowed when: R\ID is specified Range: 64 characters	Name of recorder-reproducer device manufacturer.
RECORDER-REPRODUCER MODEL	R-x\RI2	Allowed when: R\ID is specified Range: 64 characters	Manufacturer's model number of recorder-reproducer device used to create the recording.
ORIGINAL RECORDING	R-x\RI3	R/R Ch 10 Status: R Allowed when: R\TC1 is not "N" Required when: Allowed Range: Enumeration Enumeration: Y — Description: Yes Enumeration: N — Description: No	Indicate if this is an original recording from the source.
ORIGINAL RECORDING DATE AND TIME	R-x\RI4	Allowed when: R\TC1 is not "N" Range: Custom date and time	Date and time original recording was created using the format defined in Subsection 9.5.1. Example 08-19-2014-17-33-59.
Creating Organization Point of Contact			
CREATING ORGANIZATION POC NAME	R-x\POC1	Allowed when: R\TC1 is not "N" Range: 24 characters	Identify the creating organization POC name for additional information
CREATING ORGANIZATION POC AGENCY	R-x\POC2	Allowed when: R\TC1 is not "N" Range: 48 characters	Identify the creating organization POC agency for additional information

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
CREATING ORGANIZATION POC ADDRESS	R-x\POC3	Allowed when: R\TC1 is not "N" Range: 48 characters	Identify the creating organization POC address for additional information
CREATING ORGANIZATION POC TELEPHONE	R-x\POC4	Allowed when: R\TC1 is not "N" Range: 20 characters	Identify the creating organization POC telephone for additional information.
DATE AND TIME OF COPY	R-x\RI5	R/R Ch 10 Status: RO Allowed when: R\TC1 is not "N" Range: Custom date and time	Date and time the copy was made using the format defined in Subsection 9.5.1. Example 08-19-2014-17-33-59
Copying Organization Point of Contact			
COPYING ORGANIZATION POC NAME	R-x\DPOC1	Allowed when: R\TC1 is not "N". Range: 24 characters	Identify the copying organization POC name for additional information
COPYING ORGANIZATION POC AGENCY	R-x\DPOC2	Allowed when: R\TC1 is not "N". Range: 48 characters.	Identify the copying organization POC agency for additional information.
COPYING ORGANIZATION POC ADDRESS	R-x\DPOC3	Allowed when: R\TC1 is not "N". Range: 48 characters.	Identify the copying organization POC address for additional information.
COPYING ORGANIZATION POC TELEPHONE	R-x\DPOC4	Allowed when: R\TC1 is not "N" Range: 20 characters	Identify the copying organization POC telephone for additional information.
POST PROCESS MODIFIED RECORDING	R-x\RI6	R/R Ch 10 Status: R Allowed when: R\TC1 is not "N" Required when: Allowed Range: Enumeration Enumeration: Y — Description: Yes Enumeration: N — Description: No	Indicate modified recording.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
POST PROCESS MODIFICATION TYPE	R-x\RI7	R/R Ch 10 Status: RO		Indicate the type of post-process modification to the recording.
		Allowed when: R\TC1 is not "N"		
		Range: Enumeration		
		Enumeration	Description	
		1	Time subset	
		2	Channel subset	
		3	Time – channel subset	
		4	Channel superset	
		5	Time subset – channel superset	
		6	Filter	
		7	Overwrite	
DATE AND TIME OF MODIFICATION	R-x\RI8	R/R Ch 10 Status: RO		Date and time the modification was made using the format defined in Subsection 9.5.1. Example 08-19-2014-17-33-59
		Allowed when: R\TC1 is not "N"		
		Range: Custom date and time		
Modifying Organization Point of Contact				
MODIFYING ORGANIZATION POC NAME	R-x\MPOC1	Allowed when: R\TC1 is not "N".		Identify the modifying organization POC name for additional information
		Range: 24 characters		
MODIFYING ORGANIZATION POC AGENCY	R-x\MPOC2	Allowed when: R\TC1 is not "N".		Identify the modifying organization POC agency for additional information.
		Range: 48 characters		
MODIFYING ORGANIZATION POC ADDRESS	R-x\MPOC3	Allowed when: R\TC1 is not "N".		Identify the modifying organization POC address for additional information.
		Range: 48 characters		
MODIFYING ORGANIZATION POC TELEPHONE	R-x\MPOC4	Allowed when: R\TC1 is not "N"		Identify the copying organization POC telephone for additional information.
		Range: 20 characters		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
CONTINUOUS RECORDING ENABLED	R-x\CRE	R/R Ch 10 Status: R		Indicate if continuous recording is enabled.
		Allowed when: R\TC1 is not "N"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
RECORDER-REPRODUCER SETUP SOURCE	R-x\RSS	R/R Ch 10 Status: R		Indicate the recorder-reproducer setup source.
		Allowed when: R\ID is specified		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		R	Setup file on RMM only	
		C	Command setup file only	
		RP	RMM primary, command secondary	
		CP	Command primary, RMM secondary	
RECORDER SERIAL NUMBER	R-x\RI9	Allowed when: R\ID is specified		Serial number of the recorder.
		Range: 64 characters		
RECORDER FIRMWARE REVISION	R-x\RI10	Allowed when: R\ID is specified		Firmware revision number for the recorder.
		Range: 256 characters		
NUMBER OF MODULES	R-x\RIM\N	Allowed when: R\ID is specified		Number of modules in the recorder.
		Range: 1-999		
MODULE ID	R-x\RIMI-n	Allowed when: R\RIM\N > 0		Identify this module.
		Range: 64 characters		
MODULE SERIAL NUMBER	R-x\RIMS-n	Allowed when: R\RIM\N > 0		Serial number of this module.
		Range: 64 characters		

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
MODULE FIRMWARE REVISION	R-x\RIMF-n	Allowed when: R\RIM\N > 0 Range: 256 characters	Firmware revision number for this module.
NUMBER OF RMMS	R-x\RMM\N	Allowed when: R\RIM\N > 0 Range: 1-99	Number of RMMs.
RMM IDENTIFIER	R-x\RMMID-n	Allowed when: R\RMM\N > 0 Range: 64 characters	Identify this RMM.
RMM SERIAL NUMBER	R-x\RMMS-n	Allowed when: R\RMM\N > 0 Range: 64 characters	Serial number of the RMM.
RMM FIRMWARE REVISION	R-x\RMMF-n	Allowed when: R\RMM\N > 0 Range: 256 characters	Firmware revision number of the RMM.
Recorder-Reproducer Ethernet Interfaces			
NUMBER OF ETHERNET INTERFACES	R-x\EI\N	R/R Ch 10 Status: RO Allowed when: R\ID is specified Range: 0-99	Number of recorder-reproducer Ethernet interfaces.
ETHERNET INTERFACE NAME	R-x\EINM-n	R/R Ch 10 Status: RO Allowed when: R\EI\N > 0 Range: 32 characters	Name of the recorder-reproducer Ethernet interface.
PHYSICAL ETHERNET INTERFACE NEW	R-x\PEIN-n	R/R Ch 10 Status: RO Allowed when: R\EI\N > 0 Range: 0-99	Number of the recorder-reproducer physical Ethernet interface
ETHERNET INTERFACE LINK SPEED NEW	R-x\EILS-n	R/R Ch 10 Status: RO Allowed when: R\EI\N > 0 Range: Enumeration Enumeration: Description 0: Auto Negotiated 1: 10Mbps 2: 100Mbps	Ethernet interface link speed.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		3	1Gbps	
		4	10Gbps	
ETHERNET INTERFACE TYPE	R-x\EIT-n	R/R Ch 10 Status: RO		Type of recorder-reproducer Ethernet interface.
		Allowed when: R\EI\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		0	Reserved	
		1	Download	
		2	Data streaming	
		3	Download and Data streaming	
		4	Control and status	
		5	Download and Control and status	
		6	Data streaming and Control and status	
		7	Download, Data streaming and Control and status	
ETHERNET INTERFACE IP ADDRESS	R-x\EIIP-n	R/R Ch 10 Status: RO		Recorder-reproducer Ethernet interface IP address: specify the IP address in the form "xxx.xxx.xxx.xxx" where each group of xxx can range from 0 to 255.
		Allowed when: R\EI\N > 0		
		Range: xxx.xxx.xxx.xxx		
		Links from: R-x\EPL\LDEIP-n		
NUMBER OF ETHERNET INTERFACE PORTS	R-x\EIIP\N-n	R/R Ch 10 Status: RO		Number of Ethernet interface ports.
		Allowed when: R\EI\N > 0		
		Range: 0-99		
PORT ADDRESS	R-x\EI\PA-n-m	R/R Ch 10 Status: RO		Recorder-reproducer Ethernet interface IP port address: specify the IP address in the form "xxxxx" where xxxxx can range from 0 to 65535 IAW ITF.
		Allowed when: R\EI\N > 0		
		Range: 0-65535		
		Links from: R-x\EPL\LDEPA-n		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
PORT TYPE	R-x\EI\PT-n-m	R/R Ch 10 Status: RO		Recorder-reproducer Ethernet interface IP port type.
		Allowed when: R\EI\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		0	Reserved	
		1	Download	
		2	Data streaming	
		4	Control and status	
		X	Sum values for multiple type	
Recorder-Reproducer Channel Group Streams				
NUMBER OF CHANNEL GROUPS	R-x\CG\N	R/R Ch 10 Status: RO		Number of recorder-reproducer channel group streams.
		Allowed when: R\ID specified		
		Range: 0-99		
CHANNEL GROUP NAME	R-x\CGNM-n	R/R Ch 10 Status: RO		Name of the recorder-reproducer channel group. First character must be alphabetic.
		Allowed when: R\CG\N > 0		
		Range: 32 characters		
		Links from: R-x\OSNM-n, R-x\EPL\LSNM-n		
CHANNEL GROUP STREAM NUMBER	R-x\CGSN-n	R/R Ch 10 Status: RO		Specify the channel group stream as an integer number.
		Allowed when: R\CG\N > 0		
		Range: 1-99		
		Links from: R-x\EPL\LSSN-n		
NUMBER OF GROUP CHANNELS	R-x\CGCH\N-n	R/R Ch 10 Status: RO		Number of channels in the channel group stream.
		Allowed when: R\CG\N > 0		
		Range: 1-65536		
GROUP CHANNEL NUMBER	R-x\CGCN-n-m	R/R Ch 10 Status: RO		Specify the channel ID, from R-x\TK1-n.
		Allowed when: R\CG\N > 0		
		Range: 0-65535		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
Recorder-Reproducer Drives and Volumes				
NUMBER OF DRIVES	R-x\DR\N	R/R Ch 10 Status: RO		Number of recorder-reproducer drives (stream destinations). Default is "1".
		Allowed when: R\ID is specified		
		Range: 0-9999		
DRIVE NAME	R-x\DRNM-n	R/R Ch 10 Status: RO		Name of the recorder-reproducer drive. First character must be alphabetic.
		Allowed when: R\DR\N > 0		
		Range: 32 characters		
DRIVE NUMBER	R-x\DRN-n	R/R Ch 10 Status: RO		Specify the drive as an integer number.
		Allowed when: R\DR\N > 0		
		Range: 1-9999		
DRIVE BLOCK SIZE	R-x\DRBS-n	R/R Ch 10 Status: RO		Specify the drive bytes per block size.
		Allowed when: R\DR\N > 0		
		Range: 1-99999999		
NUMBER OF DRIVE VOLUMES	R-x\DRVL\N-n	R/R Ch 10 Status: RO		Number of volumes in the drive. Default is "1".
		Allowed when: R\DR\N > 0		
		Range:1-9999		
VOLUME NAME	R-x\VLNM-n-m	R/R Ch 10 Status: RO		Name of the drive volume. First character must be alphabetic.
		Allowed when: R\DR\N > 0		
		Range: 32 characters		
VOLUME NUMBER	R-x\VLN-n-m	R/R Ch 10 Status: RO		Specify the volume as an integer number.
		Allowed when: R\DR\N > 0		
		Range: Integer, 1-9999		
VOLUME BLOCKS TO ALLOCATE	R-x\VLBA-n-m	R/R Ch 10 Status: RO		Specify how volume blocks will be allocated.
		Allowed when: R\DR\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		0	All	
		1	Available	
		2	Number of blocks	

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
VOLUME NUMBER OF BLOCKS	R-x\VLNB-n-m	R/R Ch 10 Status: RO Allowed when: R\DR\N > 0 Range: max 32 digits	Specify the volume as an integer number of blocks.
Recorder-Reproducer Stream/Drive-Volume Links			
NUMBER OF LINKS	R-x\L\N	R/R Ch 10 Status: RO Allowed when: R\ID is specified Range: 0-99	Number of recorder-reproducer channel group streams/drive-volume links.
LINK NAME	R-x\LNM-n	R/R Ch 10 Status: RO Allowed when: R\L\N > 0 Range: 32 characters	Name of the recorder-reproducer channel group stream/drive-volume link. First character must be alphabetic.
LINK SOURCE STREAM NAME	R-x\LSNM-n	R/R Ch 10 Status: RO Allowed when: R\L\N > 0 Range: 32 characters	Specify the recorder-reproducer channel group stream name.
LINK SOURCE STREAM NUMBER	R-x\LSSN-n	R/R Ch 10 Status: RO Allowed when: R\L\N > 0 Range: Integer, 1-99	Specify the recorder-reproducer channel group stream/drive-volume number, from R-x\CGSN-n.
LINK DESTINATION DRIVE NUMBER	R-x\LDDN-n	R/R Ch 10 Status: RO Allowed when: R\L\N > 0 Range: Integer, 1-9999	Specify the recorder-reproducer channel group stream destination drive number, from R-x\DRN-n.
LINK DESTINATION VOLUME NUMBER	R-x\LDVN-n	R/R Ch 10 Status: RO Allowed when: R\L\N > 0 Range: Integer, 1-9999	Specify the recorder-reproducer channel group stream destination volume number, from R-x\VLN-n-m.
Recorder-Reproducer Ethernet Interface Publishing Links			
NUMBER OF ETHERNET PUBLISHING LINKS	R-x\EPL\N	R/R Ch 10 Status: RO Allowed when: R\ID is specified Range: 0-99	Number of Stream/Ethernet Interface Publish Links

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
ETHERNET PUBLISHING LINK NAME	R-x\EPL\LNM-n	R/R Ch 10 Status: RO Allowed when: R\EPL\N > 0 Range: 32 characters	Name of Stream/Ethernet Interface Publish Links
LINK SOURCE STREAM NAME	R-x\EPL\LSNM-n	R/R Ch 10 Status: RO Allowed when: R\EPL\N > 0 Range: 32 characters Links to: R-x\CGNM-n	The Channel Group Stream Name to link this Ethernet Publishing Interface.
LINK SOURCE STREAM NUMBER	R-x\EPL\LSSN-n	R/R Ch 10 Status: RO Allowed when: R\EPL\N > 0 Range = 0-99 Links to: R-x\CGSN-n	The Channel Group Stream Number to link this Ethernet Publishing Interface from R-X\CGSN.
LINK DESTINATION ETHERNET INTERFACE IP ADRESS	R-x\EPL\LDEIP-n	R/R Ch 10 Status: RO Allowed when: R\EPL\N > 0 Range: xxx.xxx.xxx.xxx Links to: R-x\EIIP-n	The Destination Ethernet interface IP address for this link.
LINK DESTINATION ETHERNET INTERFACE PORT ADDRESS	R-x\EPL\LDEPA-n	R/R Ch 10 Status: RO Allowed when: R\EPL\N > 0 Range: 0-65535 Links to: R-x\EI\PA	The Destination Ethernet interface port address for this link.
Computer-Generated Data Packet, User-Defined Definition			
USER-DEFINED CHANNEL ID	R-x\UD\TK1	R/R Ch 10 Status: RO Allowed when: R\ID is specified Range: 1-65535	Specify the channel ID for computer-generated user-defined packets.
Recording Event Definitions			
RECORDING EVENTS ENABLED	R-x\EV\E	R/R Ch 10 Status: RO Allowed when: R\ID is specified Range: Enumeration	Indicate if events are enabled. Events must be enabled to generate event packets.

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Enumeration	Description	
		T	True	
		F	False	
		Default: F		
RECORDING EVENTS CHANNEL ID	R-x\EV\TK1	R/R Ch 10 Status: RO		Specify the channel ID for recording event packets.
		Allowed when: R\EV\E = "T"		
		Required when: Allowed		
		Range: 1-65535		
NUMBER OF RECORDING EVENTS	R-x\EV\N	R/R Ch 10 Status: RO		Specify the number of individual recording event types.
		Allowed when: R\EV\E = "T"		
		Required when: Allowed		
		Range: 1-999		
RECORDER INTERNAL EVENTS ENABLED	R-x\EV\IEE	R/R Ch 10 Status: RO		Indicate if recorder internal events are enabled.
		Allowed when: R\EV\E = "T"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
Recording Event				
EVENT ID	R-x\EV\ID-n	R/R Ch 10 Status: RO		Identify the name of the individual recording event.
		Allowed when: R\EV\N > 0		
		Range: 32 characters		
EVENT DESCRIPTION	R-x\EV\D-n	R/R Ch 10 Status: RO		Identify the description of the event.
		Allowed when: R\EV\N > 0		
		Range: 256 characters		
EVENT DATA PROCESSING ENABLED	R-x\EV\EDP-n	Allowed when: R\EV\N > 0		Indicate if event data processing is enabled.
		Range: Enumeration		
		Enumeration	Description	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		T	True	
		F	False	
EVENT TYPE	R-x\EV\T-n	R/R Ch 10 Status: RO		Indicate the recording event type.
		Allowed when: R\EV\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		E	External	
		D	Measurement discrete	
		L	Measurement limit	
		R	Recorder	
		O	Other	
		Default: R		
EVENT PRIORITY	R-x\EV\P-n	R/R Ch 10 Status: RO		Indicate the recording event priority.
		Allowed when: R\EV\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		1	Priority 1	
		2	Priority 2	
		3	Priority 3	
		4	Priority 4	
		5	Priority 5	
EVENT CAPTURE MODE	R-x\EV\CM-n	R/R Ch 10 Status: RO		Indicate the recording event capture mode.
		Allowed when: R\EV\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		1	Mode 1	
		2	Mode 2	
		3	Mode 3	
		4	Mode 4	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		5	Mode 5	
		6	Mode 6	
		7	Mode 7	
EVENT INITIAL CAPTURE	R-x\EV\IC-n	R/R Ch 10 Status: RO		Indicate if initial capture of event is enabled.
		Allowed when: R\EV\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
RECORDING EVENT LIMIT COUNT	R-x\EV\LC-n	R/R Ch 10 Status: RO		Specify the limit count for the individual recording event.
		Allowed when: R\EV\N > 0		
		Range: 1-99999999		
EVENT TRIGGER MEASUREMENT SOURCE	R-x\EV\MS-n	R/R Ch 10 Status: RO		Identify the data link name consistent with the mux/mod group that contains the event trigger measurement if event type is “D” or “L”.
		Allowed when: R\EV\N > 0		
		Range: 32 characters		
EVENT TRIGGER MEASUREMENT NAME	R-x\EV\MN-n	R/R Ch 10 Status: RO		Identify the event trigger measurand name if the event type is “D” or “L”.
		Allowed when: R\EV\N > 0		
		Range: 32 characters		
EVENT PROCESSING MEASUREMENT DATA LINK NAME	R-x\EV\DLN-n	Allowed when: R\EV\N > 0		Identify the data link name consistent with the PCM format and PCM measurement groups, bus data group, or message data group that contains the measurements to be processed.
		Links to: P-d\DLN, B-x\DLN, S-d\DLN		
		Range: 32 characters		
NUMBER OF MEASUREMENTS TO PROCESS	R-x\EV\PM\N-n	Allowed when: R\EV\N > 0		Specify the number of measurements to process for this event.
		Range: 0-9999		
MEASUREMENT NAME TO PROCESS	R-x\EV\PM\MN-n-m	Allowed when: R\EV\PM\N > 0		Identify the measurement name to be processed for the event.
		Links to: B-x\MN-i-n-p, D-x\MN-y-n, S-d\MN-i-n-p		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		Range: 32 characters		
PRE-EVENT PROCESSING DURATION	R-x\EV\PM\PRE-n-m	Allowed when: R\EV\PM\N > 0		Specify the number of seconds the measurement will be processed before the event time.
		Range: 0-9999		
POST-EVENT PROCESSING DURATION	R-x\EV\PM\PST-n-m	Allowed when: R\EV\PM\N > 0		Specify the number of seconds the measurement will be processed after the event time.
		Range: 0-9999		
Recording Index				
RECORDING INDEX ENABLED	R-x\IDX\E	R/R Ch 10 Status: RO		Indicate if index is enabled. Index must be enabled to generate index packets.
		Allowed when: R\ID is specified		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
RECORDING INDEX CHANNEL ID	R-x\IDX\TK1	R/R Ch 10 Status: RO		Specify the channel ID for recording index packets.
		Allowed when: R\IDX\E = "T"		
		Required when: Allowed		
		Range: 1 – 65535		
RECORDING INDEX TYPE	R-x\IDX\IT	R/R Ch 10 Status: RO		Specify index type for recording index packets.
		Allowed when: R\IDX\E = "T"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		T	Time	
		C	Count	
Time Index Type Attribute				
INDEX TIME VALUE	R-\IDX\ITV	R/R Ch 10 Status: RO		Identify the number of microseconds for each index entry generation.
		Allowed when: R\IDX\E = "T"		
		Range: 0-99999999		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
Count Index Type Attribute				
INDEX COUNT VALUE	R-\IDX\ICV	R/R Ch 10 Status: RO Allowed when: R\IDX\E = "T" Range: 0-9999		Identify the number of packets for each index entry generation.
MIL-STD-1553 Recorder Control				
MESSAGE MONITOR RECORD CONTROL ENABLED	R-x\MRC\E	Allowed when: R\ID is specified Range: Enumeration Enumeration / Description T / True F / False		Indicate if message monitor record control is enabled.
CHANNEL ID NUMBER	R-x\MRC\ID	Allowed when: R\MRC\E = "T" Range: 1-65535		Specify the MIL-STD-1553 channel ID that contains the record control message.
MESSAGE RECORD CONTROL TYPE	R-x\MRC\RCT	Allowed when: R\MRC\E = "T" Range: Enumeration Enumeration / Description 0 / Stop-start 1 / Pause-resume		Specify the MIL-STD-1553 message monitor record control type.
STOP-PAUSE COMMAND WORD	R-x\MRC\SPM	Allowed when: R\MRC\E = "T" Range: Hexadecimal, 0000-FFFF		Specify the command word of the MIL-STD-1553 message to be used for stop-pause.
START-RESUME COMMAND WORD	R-x\MRC\SRM	Allowed when: R\MRC\E = "T" Range: Hexadecimal, 0000-FFFF		Specify the command word of the MIL-STD-1553 message to be used for start-resume.
Data				
NOTE: Define information contained on each track of the tape or each channel of the storage media.				
TRACK NUMBER/ CHANNEL ID	R-x\TK1-n	R/R Ch 10 Status: R Allowed when: R\N > 0 Required when: Allowed Range: 1-65535		Specify the track number or the channel ID that contains the data to be specified.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
RECORDING TECHNIQUE	R-x\TK2-n	Allowed when: R\N > 0		Specify the recording technique used for this track.
		Range: Enumeration		
		Enumeration	Description	
		FM/FM	Indirect FM	
		HDDR	Hard Disk Recording	
		PRE_D	Pre-detection	
		DIRECT	Direct FM	
		FMWBI	FM-Wide Band GRP I	
		FMWBII	FM-Wide Band GRP II	
		FM-IM	FM-Intermediate Band	
		FM-NB	FM-Narrow Band	
		DOUDEN	Double Density	
		RO-K	(Rotary [Single Track])	
		RO-MUX	(Rotary [Multiplexed])	
		SSR	Solid State	
		OTHER	All other techniques	
INPUT STREAM DE-RANDOMIZATION	R-x\IDDR-n	Allowed when: R\N > 0		Specify how input stream is recorded. Stream is recorded after being derandomized. Stream is recorded as received. If PCM data type is not throughput and input data stream is randomized, this parameter must be “Y”.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
DATA SOURCE ID	R-x\DSI-n	R/R Ch 10 Status: R		Specify the data source identification. For a site-recorded multiplexed track, provide a data source identification.
		Allowed when: R\N > 0		
		Links from: G\DSI-n		
		Links to: M-x\ID		
		Required when: Allowed		
		Range: 32 characters		
DATA DIRECTION	R-x\TK3-n	Allowed when: R\N > 0		Specify data direction.

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Range: Enumeration		
		Enumeration	Description	
		FWD	Forward	
		REV	Reverse	
		Default: FWD		
RECORDER PHYSICAL CHANNEL NUMBER	R-x\TK4-n	R/R Ch 10 Status: R		Specify the recorder physical channel for the channel ID (TK1).
		Allowed when: R\N > 0		
		Required when: Allowed		
		Range: 1-65535		
CHANNEL ENABLE	R-x\CHE-n	R/R Ch 10 Status: R		Indicate if source is enabled. Source must be enabled to generate data packets.
		Allowed when: R\N > 0		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
CHANNEL DATA TYPE	R-x\CDT-n	R/R Ch 10 Status: R		Specify the type of source if “STO” was specified in G group data source type.
		Allowed when: R\N > 0		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		PCMIN	PCM Input	
		VIDIN	Video Input	
		ANAIN	Analog Input	
		1553IN	1553 Input	
		DISIN	Discrete Input	
		TIMEIN	IRIG Time Input	
		UARTIN	UART Input	
		429IN	ARINC 429 Input	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		MSGIN	Message Data Input	
		IMGIN	Image Data Input	
		1394IN	IEEE-1394 Input	
		PARIN	Parallel Input	
		ETHIN	Ethernet Input	
		TSPIIN	TSPI/CTS Input	
		CANIN	CAN bus Input	
		FBCHIN	Fibre Channel Input	
		TMOUT	Telemetry Output	
CHANNEL DATA LINK NAME	R-x\CDLN-n	R/R Ch 10 Status: R		Identify the data link name consistent with the PCM format, bus data, or message data group for the channel.
		Allowed when: R\N > 0		
		Required when: A data link is associated with the channel.		
		Links to: P-d\DLN, B-x\DLN, S-d\DLN		
		Range: 32 characters		
SECONDARY HEADER TIME FORMAT	R-x\SHTF-n	R/R Ch 10 Status: RO		If enabled, the secondary header time format.
		Allowed when: R\N > 0		
		Range: Enumeration		
		Enumeration	Description	
		0	Chapter 4 BCD	
		1	IEEE-1588	
		2	ERTC	
Data Type Attributes				
PCM Data Type Attributes				
PCM DATA TYPE FORMAT	R-x\PDTF-n	R/R Ch 10 Status: RO		PCM data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is “PCMIN”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		0	reserved	
		1	Chapter 4, Chapter 7, Chapter 8	
DATA PACKING OPTION	R-x\PDP-n	R/R Ch 10 Status: RO		How data is placed in the packets.
		Allowed when: R\CDT is "PCMIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		UN	Unpacked	
		TM	Throughput mode	
		PFS	Packed with frame sync	
RECORDER POLARITY SETTING NEW	R-x\RPS-n	R/R Ch 10 Status: RO		Recorder Data polarity setting. Specify if the recorder is to invert the input stream before recording it.
		Allowed when: P-d\CDT is "PCMIN"		
		Range: Enumeration		
		Enumeration	Description	
		N	Normal – Do not invert data prior to recording	
		I	Invert data prior to recording	
		Default: N		
INPUT CLOCK EDGE CHANGE	R-x\ICE-n	R/R Ch 10 Status: RO		Specify the input clock edge relative to the data in degrees.
		Allowed when: R\CDT is "PCMIN"		
		Range: Enumeration		
		Enumeration	Description	
		0	0 degrees	
		180	180 degrees	
		Default: 0		
INPUT SIGNAL TYPE CHANGE	R-x\IST-n	R/R Ch 10 Status: RO		Type of input signal.
		Allowed when: R\CDT is "PCMIN"		
		Range: Enumeration		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Enumeration	Description	
		SE	Single ended	
		DIFF	Differential	
		RS422	RS-422 standard differential	
		TTL	Single ended with TTL	
		Default: DIFF		
INPUT THRESHOLD	R-x\ITH-n	R/R Ch 10 Status: RO		Specify the input threshold level for selectable electrical interface. The value is the threshold level in volts.
		Allowed when: R\CDT is “PCMIN”		
		Required when: Allowed		
		Range: −999.9 to 999.9		
INPUT TERMINATION	R-x\ITM-n	R/R Ch 10 Status: RO		Specify the input termination.
		Allowed when: R\CDT is “PCMIN”		
		Range: Enumeration		
		Enumeration	Description	
		LOW-Z	Low impedance	
		HIGH-Z	High impedance	
PCM VIDEO TYPE FORMAT	R-x\PTF-n	R/R Ch 10 Status: RO		Compression technique for video recorded as standard Chapter 4 PCM. The compressed data is encapsulated in ISO Standard Transport Stream (TS) frames. If type format is “OTHER”, then a vendor spec is required to identify the data compression technique. Specify “NONE” if data is not video data.
		Allowed when: R\CDT is “PCMIN”		
		Range: Enumeration		
		Enumeration	Description	
		NONE	Not video	
		MPEG1	MPEG1 Compression	
		MPEG2	MPEG2 Compression	
		H261	H.261 Compression	
		WAVE	Wavelet Compression	
		OTHER	Other Compression (including uncompressed)	
		Default: NONE		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
PCM RECORDER-REPRODUCER MINOR FRAME FILTERING ENABLED	R-x\MFF\E-n	R/R Ch 10 Status: RO		Indicate if recorder-reproducer minor frame filtering is enabled for the PCM channel (not applicable for throughput mode PCM channels).
		Allowed when: R\PDP = "PFS" or "UN"		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
PCM POST-PROCESS OVERWRITE AND FILTERING ENABLED	R-x\POF\E-n	R/R Ch 10 Status: RO		Indicate if post-process overwrite and filtering is enabled for the PCM channel.
		Allowed when: R\PDP = "PFS" or "UN"		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
PCM POST-PROCESS OVERWRITE AND FILTERING TYPE	R-x\POF\T-n	R/R Ch 10 Status: RO		Indicate the type of post-process overwrite and filtering for the PCM channel.
		Allowed when: R\POF\E = "T"		
		Range: Enumeration		
		Enumeration	Description	
		MF	Minor frame	
		SM	Selected measurement	
		B	Both	
MINOR FRAME FILTERING DEFINITION TYPE	R-x\MFF\FDT-n	R/R Ch 10 Status: RO-PAK		Specify the PCM minor frame filtering definition type.
		Allowed when: R\POF\T is "B" or "MF" or R\MFF\E is "T"		
		Range: Enumeration		
		Enumeration	Description	
		IN	Inclusive filtering	
		EX	Exclusive filtering	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes	Definition
NUMBER OF MINOR FRAME FILTERING DEFINITIONS	R-x\MFF\N-n	R/R Ch 10 Status: RO-PAK Allowed when: R\POF\T is "B" or "MF" or R\MFF\E is "T" Range: 0-999	Specify the number of PCM minor frame filtering definitions.
FILTERED MINOR FRAME NUMBER	R-x\MFF\MFN-n-m	R/R Ch 10 Status: RO-PAK Allowed when: R\MFF\N > 0 Required when: Allowed Range: 0-999	Specify the PCM minor frame number to be filtered.
NOTE: For PCM formats with multiple subframe ID counters, all minor frame numbers defined for filtering are associated with the first subframe ID counter.			
NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	R-x\SMF\N-n	R/R Ch 10 Status: RO Allowed when: R\POF\T is "B" or "SM" or R\MFF\E is "T" Range: 0-99	Specify the number of PCM selected measurement overwrite definitions.
SELECTED MEASUREMENT NAME	R-x\SMF\SMN-n-m	R/R Ch 10 Status: RO Allowed when: R\SMF\N > 0 Required when: Allowed Links to: D-x\MN-y-n Range: 32 characters	Specify the PCM selected measurement name to be overwritten.
MEASUREMENT OVERWRITE TAG	R-x\SMF\MFOT-n-m	R/R Ch 10 Status: RO Allowed when: R\SMF\N > 0 Range: Enumeration Enumeration: O — Overwrite; N — No overwriting Default: N	Indicate if the PCM measurement is tagged for overwriting.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
MIL-STD-1553 Bus Data Type Attributes				
MIL-STD-1553 BUS DATA TYPE FORMAT	R-x\BTF-n	R/R Ch 10 Status: RO		MIL-STD-1553 bus data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "1553IN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	reserved	
		1	MIL-STD-1553B data	
		2	16PP194 bus	
MIL-STD-1553 RECORDER-REPRODUCER FILTERING ENABLED	R-x\MRF\E-n	R/R Ch 10 Status: RO		Indicate if recorder-reproducer filtering is enabled for the MIL-STD-1553 channel.
		Allowed when: R\CDT is "1553IN"		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
MIL-STD-1553 POST-PROCESS OVERWRITE AND FILTERING ENABLED	R-x\MOF\T-n	R/R Ch 10 Status: RO		Indicate if post-process overwrite and filtering is enabled for the MIL-STD-1553 channel.
		Allowed when: R\CDT is "1553IN"		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
MIL-STD-1553 MESSAGE FILTERING DEFINITION TYPE	R-x\MFD\FDT-n	Allowed when: R\MRF\E or R\MOF\T is "T"		Specify the message filtering definition type.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		IN	Inclusive filtering	
		EX	Exclusive filtering	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
NUMBER OF MESSAGE FILTERING DEFINITIONS	R-x\MFD\N-n	Allowed when: R\MRF\E or R\MOF\T is "T"		Specify the number of message filtering definitions.
		Required when: Allowed		
		Range: 0-99		
MESSAGE NUMBER	R-x\MFD\MID-n-m	Allowed when: R\MFD\N > 0		Specify the message number to be filtered and overwritten.
		Required when: Allowed		
		Range: 1-999999999		
MESSAGE TYPE	R-x\MFD\MT-n-m	Allowed when: R\MFD\N > 0		Specify the message type.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		RTRT	RT/RT	
		RTBC	RT/BC	
		BCRT	BC/RT	
		MC	Mode code	
COMMAND WORD ENTRY	R-x\CWE-n-m	Allowed when: R\MFD\N > 0		Method used to specify the command word.
		Range: Enumeration		
		Enumeration	Description	
		W	Enter the entire command word in the "COMMAND WORD" attribute.	
		F	Enter the command word fields separately in the "REMOTE TERMINAL ADDRESS", "SUBTERMINAL ADDRESS", "TRANSMIT/ RECEIVE MODE", and "DATA WORD COUNT/ MODE CODE" attributes.	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		Default: F		
COMMAND WORD	R-x\CMD-n-m	Allowed when: R\MFD\N > 0		Specify the entire command word for this message.
		Required when: R\RCWE is "W"		
		Range: Hexadecimal, 0000-FFFF		
REMOTE TERMINAL ADDRESS	R-x\MFD\TRA-n-m	Allowed when: R\MFD\N > 0		Specify the five-bit remote terminal address for this message. Use "X" to indicate a "don't care" value.
		Required when: R\CWE is "F"		
		Range: Binary 00000-11111		
TRANSMIT/ RECEIVE MODE	R-x\MFD\TRM-n-m	Allowed when: R\MFD\N > 0		Indicate if this command word is a transmit or receive command. For RT/RT, specify transmit.
		Required when: R\CWE is "F"		
		Range: Enumeration		
		Enumeration	Description	
		1	Transmit	
		0	Receive	
SUBTERMINAL ADDRESS	R-x\MFD\STA-n-m	Allowed when: R\MFD\N > 0		Specify the five-bit subterminal address for this message. Use "X" to indicate a "don't care" value.
		Required when: R\CWE is "F"		
		Range: Binary 00000-11111		
DATA WORD COUNT/MODE CODE	R-x\MFD\DWC-n-m	Allowed when: R\MFD\N > 0		Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. If the subterminal address indicates a mode code, enter the mode code value as a binary string.
		Required when: R\CWE is "F"		
		Range: Binary 00000-11111		
RECEIVE COMMAND WORD ENTRY	R-x\RCWE-n-m	Allowed when: R\MFD\N > 0		Method used to specify the receive command word.
		Range: Enumeration		
		Enumeration	Description	
		W	Enter the entire command word in the "RECEIVE COMMAND WORD" attribute.	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		F	Enter the command word fields separately in the "RT/RT REMOTE TERMINAL ADDRESS", "RT/RT SUBTERMINAL ADDRESS", and "RT/RT DATA WORD COUNT" attributes.	
		Default: F		
RECEIVE COMMAND WORD	R-x\RCMD-n-m	Allowed when: R\MFD\N > 0		Specify the entire receive command word for this RT/RT message.
		Required when: R\RCWE is "W"		
		Range: Hexadecimal, 0000-FFFF		
RT/RT REMOTE TERMINAL ADDRESS	R-x\MFD\RTRA-n-m	Allowed when: R\MFD\N > 0		Specify the five-bit remote terminal address for this RT/RT message. Use "X" to indicate a "don't care" value.
		Required when: R\RCWE is "F"		
		Range: Binary, 00000 - 11111		
RT/RT SUBTERMINAL ADDRESS	R-x\MFD\RSTA-n-m	Allowed when: R\MFD\N > 0		Specify the five-bit subterminal address for this RT/RT message. Use "X" to indicate a "don't care" value.
		Required when: R\RCWE is "F"		
		Range: Binary 00000 - 11111		
RT/RT DATA WORD COUNT	R-x\MFD\RDWC-n-m	Allowed when: R\MFD\N > 0		Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. Exclude status and time words (an RT/RT message cannot contain a mode code).
		Required when: R\RCWE is "F"		
		Range: Binary 00000 - 11111		
NUMBER OF SELECTED MEASUREMENT OVERWRITE DEFINITIONS	R-x\BME\N-n	R/R Ch 10 Status: RO		Specify the number of bus measurement overwrite definitions.
		Allowed when: R\MRF\E or R\MOF\T is "T"		
		Range: 0-99		
SELECTED MEASUREMENT NAME	R-x\BME\SMN-n-m	R/R Ch 10 Status: RO		Specify the bus measurement name to be overwritten.
		Allowed when: R\BME\N > 0		
		Required when: Allowed		
		Links to: B-x\MN-i-n-p		

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Range: 32 characters	
MEASUREMENT OVERWRITE TAG 	R-x\BME\MFOT-n-m	R/R Ch 10 Status: RO Allowed when: R\BME\N > 0 Range: Enumeration Enumeration: Description O: Overwrite N: No overwriting Default: N	Indicate if the bus measurement is tagged for overwriting.
Analog Data Type Attributes			
ANALOG DATA TYPE FORMAT	R-x\ATF-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Required when: Allowed Range: Enumeration Enumeration: Description 0: Reserved 1: Analog data	Analog data type format. Enumeration equates to format number in Chapter 10.
NUMBER OF ANALOG CHANNELS/PKT	R-x\ACH\N-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Required when: Allowed Range: Integer, 1-256	Specify the number of analog channels per packet.
DATA PACKING OPTION 	R-x\ADP-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Range: Enumeration Enumeration: Description YES: Packed NO: Unpacked Default: YES	How data is placed in the packets.
SAMPLE RATE	R-x\ASR-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN"	Sample rate of the fastest channel(s) in samples per second.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes	Definition
		Required when: Allowed Range: positive floating point	
SUB CHANNEL ENABLED CHANGE	R-x\AMCE-n-m	R/R Ch 10 Status: R Allowed when: R\CDT is "ANAIN" Range: Enumeration Enumeration: T = True; F = False Default: T	Indicate if sub-channel is enabled.
SUB CHANNEL NUMBER	R-x\AMCN-n-m	R/R Ch 10 Status: R Allowed when: R\CDT is "ANAIN" Required when: Allowed Range: 1-256	Indicate the analog sub channel number associated with the -n–m sub channel. First subchannel is 1.
MEASUREMENT NAME	R-x\AMN-n-m	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Required when: R-x\ACH\N > 1 Links to: C-d\DCN Range: 32 characters	Identify the measurement name consistent with the Data Conversion group for an analog channel.
DATA LENGTH	R-x\ADL-n-m	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Required when: Allowed Range: 1-64	Number of bits per data word.
BIT MASK CHANGE	R-x\AMSK-n-m	R/R Ch 10 Status: RO Allowed when: R\CDT is "ANAIN" Range: Binary, maximum 64 characters or "FW" Default: FW	Binary string of 1s and 0s to identify the bits in a word location that are assigned to this measurement. If the full word is used for this measurement, enter "FW." Left-most bit corresponds to the msb.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
MEASUREMENT TRANSFER ORDER	R-x\AMTO-n-m	R/R Ch 10 Status: RO		Define the first bit transferred in normal time sequence.
		Allowed when: R\CDT is "ANAIN"		
		Range: Enumeration		
		Enumeration	Description	
		M	msb first	
		L	lsb first	
		D	msb first	
		Default: M		
SAMPLE FACTOR	R-x\ASF-n-m	R/R Ch 10 Status: RO		1/(2^n) times the fastest sample rate (defined above) gives the sample rate for this channel. Specify the value "n" in this field.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: 0-63		
SAMPLE FILTER 3DB BANDWIDTH	R-x\ASBW-n-m	R/R Ch 10 Status: RO		Sample filter in units of Hz.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: positive floating point		
AC/DC COUPLING	R-x\ACP-n-m	R/R Ch 10 Status: RO		Analog signal coupling.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		A	AC Coupled	
		D	DC Coupled	
RECORDER INPUT IMPEDANCE	R-x\AII-n-m	R/R Ch 10 Status: RO		Analog signal input impedance to the recorder. Units of ohms.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: positive floating point		
INPUT CHANNEL GAIN	R-x\AGI-n-m	R/R Ch 10 Status: RO		Signal gain of analog signal. Milli units (10x = 010000).
		Allowed when: R\CDT is "ANAIN"		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Required when: Allowed		
		Range: positive floating point		
INPUT FULL SCALE RANGE	R-x\AFSI-n-m	R/R Ch 10 Status: RO		Full-scale range of input signal. Units of millivolts (20vpp = 020000) (vpp = 2xvp).
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: positive floating point		
INPUT OFFSET VOLTAGE	R-x\AOVI-n-m	R/R Ch 10 Status: RO		Offset voltage of input signal. Units of millivolts (10v=010000).
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: positive floating point		
RECORDED ANALOG FORMAT	R-x\AF-n-m	R/R Ch 10 Status: RO		Format of input signal.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		1	One's complement	
		2	Two's complement	
		3	(Sign and magnitude binary [+=0])	
		4	(Sign and magnitude binary [+=1])	
		B	Offset binary	
		U	Unsigned binary	
		F	(IEEE 754 single-precision [IEEE 32] floating point)	
INPUT TYPE	R-x\AIT-n-m	R/R Ch 10 Status: RO		Type of input signal.
		Allowed when: R\CDT is "ANAIN"		
		Required when: Allowed		
		Range: Enumeration		

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Enumeration	Description	
		S	Single-ended	
		D	Differential	
AUDIO	R-x\AV-n-m	R/R Ch 10 Status: RO		Indicate if input signal is audio.
		Allowed when: R\CDT is “ANAIN”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		Y	Audio present	
		N	Audio not present	
AUDIO FORMAT	R-x\AVF-n-m	R/R Ch 10 Status: RO		Format of audio if present.
		Allowed when: R\AV is “Y”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		RAW	Raw, headerless PCM	
		WAV	Waveform Audio	
		LPCM	Linear PCM	
		AC3	Dolby AC-3	
		PRED	“PRED” format	
		PSTD	“PSTD” format	
		CVSD	Continuously Variable Slope Delta modulation	
		O	Other	
Discrete Data Type Attributes				
DISCRETE DATA TYPE FORMAT	R-x\DTF-n	R/R Ch 10 Status: RO		Discrete data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is “DISIN”		
		Required when: Allowed		
		Range: Enumeration		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		Enumeration	Description	
		0	Reserved	
		1	Discrete data	
DISCRETE MODE	R-x\DMOD-n	R/R Ch 10 Status: RO		Indicate the mode whereby discrete events are placed in the packets.
		Allowed when: R\CDT is "DISIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		EV	Event mode	
		SAMP	Sample mode	
SAMPLE RATE	R-x\DSR-n	R/R Ch 10 Status: RO		Sample rate in samples per second.
		Allowed when: R\CDT is "DISIN"		
		Required when: Allowed		
		Range: positive floating point		
NUMBER OF DISCRETE MEASUREMENTS	R-x\NDM\N-n	R/R Ch 10 Status: RO		Specify the number of discrete measurements.
		Allowed when: R\CDT is "DISIN"		
		Required when: Allowed		
		Range: 0-999		
MEASUREMENT NAME	R-x\DMN-n-m	R/R Ch 10 Status: RO		Identify the measurement name consistent with the data conversion group for one or more discrete bits.
		Allowed when: R\NDM\N > 0		
		Required when: Allowed		
		Links to: C-d\DCN		
		Range: 32 characters		
BIT MASK	R-x\DMSK-n-m	R/R Ch 10 Status: RO		Binary string of 1s and 0s to identify the bits in a word location that are assigned to this measurement. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
		Allowed when: R\NDM\N > 0		
		Required when: Allowed		
		Range: Binary, max 16 characters or "FW'		

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
MEASUREMENT TRANSFER ORDER	R-x\DMTO-n-m	R/R Ch 10 Status: RO Allowed when: R\NDM\N > 0 Range: Enumeration Enumeration: Description M: msb first L: lsb first D: msb first Default: M	Shows msbs and least significant bits (lsbs).
ARINC 429 Bus Data Type Attributes			
ARINC 429 BUS DATA TYPE FORMAT	R-x\ABTF-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "429IN" Required when: Allowed Range: Enumeration Enumeration: Description 0: ARINC 429 data 1: Reserved	ARINC 429 bus data type format. Enumeration equates to format number in Chapter 10.
NUMBER OF ARINC 429 SUB-CHANNELS	R-x\NAS\N-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "429IN" Required when: Allowed Range: 1-256	Number of ARINC 429 bus sub-channels.
ARINC 429 SUB-CHANNEL NUMBER	R-x\ASN-n-m	R/R Ch 10 Status: RO Allowed when: R\NAS\N > 0 Required when: Allowed Range: 1-256.	ARINC 429 bus sub-channel ID. First sub-channel is 1.
ARINC 429 SUB-CHANNEL NAME	R-x\ANM-n-m	R/R Ch 10 Status: RO Allowed when: R\NAS\N > 0 Required when: Allowed Range: 32 characters	ARINC 429 bus sub-channel name.

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
Video Data Type Attributes				
VIDEO DATA TYPE FORMAT	R-x\VTF-n	R/R Ch 10 Status: RO		Video data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "VIDIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	MPEG-2/H.264	
		1	MPEG-2 ISO 13818	
		2	MPEG-4 ISO 14496	
MPEG-2 CHANNEL XON2 FORMAT	R-x\VXF-n	R/R Ch 10 Status: RO		Type of video carried for XON2 formats (MPEG-2 video channels). "0" (2ON2 [MPEG-2]). "1" (264ON2 [H.264]).
		Allowed when: R\CDT is "VIDIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	2ON2 (MPEG-2)	
		1	264ON2 (H.264)	
VIDEO SIGNAL TYPE	R-x\VST-n	R/R Ch 10 Status: RO		The video signal input type.
		Allowed when: R\CDT is "VIDIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Auto detect	
		1	Composite	
		2	YUV	
		3	S-VIDEO	
		4	DVI	
		5	RGB	
		6	SDI	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		7	VGA	
VIDEO SIGNAL FORMAT TYPE	R-x\VSF-n	R/R Ch 10 Status: RO		The video signal input type.
		Allowed when: R\CDT is “VIDIN”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Auto detect	
		1	NTSC	
		2	PAL	
		3	ATSC	
		4	DVB	
		5	ISDB	
		6	SECAM	
VIDEO CONSTANT BIT RATE	R-x\CBR-n	R/R Ch 10 Status: RO		Contains aggregate stream bit rate in bits per second.
		Allowed when: R\CDT is “VIDIN”		
		Required when: Allowed		
		Range: positive floating point		
VIDEO VARIABLE PEAK BIT RATE	R-x\VBR-n	R/R Ch 10 Status: RO		Contains peak stream bit rate in bits per second.
		Allowed when: R\CDT is “VIDIN”		
		Required when: Allowed		
		Range: positive floating point		
VIDEO ENCODING DELAY	R-x\VED-n	R/R Ch 10 Status: RO		Delay introduced by video encoding hardware in milliseconds.
		Allowed when: R\CDT is “VIDIN”		
		Required when: Allowed		
		Range: positive floating point		
OVERLAY ENABLED	R-x\VCO\OE-n	Allowed when: R\CDT is “VIDIN”		Indicate if overlay is enabled.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		T	True	
		F	False	
OVERLAY X POSITION	R-x\VCO\X-n	Allowed when: R\VCO\OE is "T"		Specify the X pixel position of the overlay in the video channel. Zero indicates the leftmost position of the video image.
		Required when: Allowed		
		Range: 0-99999		
OVERLAY Y POSITION	R-x\VCO\Y-n	Allowed when: R\VCO\OE is "T"		Specify the Y line position of the overlay in the video channel. Zero indicates the uppermost position of the video image.
		Required when: Allowed		
		Range: 0-99999		
OVERLAY EVENT TOGGLE ENABLED	R-x\VCO\OET-n	Allowed when: R\VCO\OE is "T"		Indicate if overlay event toggle is enabled.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
OVERLAY FORMAT	R-x\VCO\OLF-n	Allowed when: R\VCO\OE is "T"		Indicate format of the time overlay.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		DT	Day and time (DDD:HH:MM:SS)	
		TO	Time only (HH:MM:SS)	
		TM	Time and milliseconds (HH:MM:SS:SSS)	
		DTM	Day, time, and milliseconds (DDD:HH:MM:SS:SSS)	
OVERLAY BACKGROUND	R-x\VCO\OBG-n	Allowed when: R\VCO\OE is "T"		Indicate background of the time overlay.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		BOT	Black on transparent	
		WOT	White on transparent	
		BOW	Black on white	
		WOB	White on black	
ANALOG AUDIO CHANNEL INPUT LEFT	R-x\ASI\ASL-n	Allowed when: R\CDT is "VIDIN"		Indicate the analog channel source of the left audio channel ID for the video channel.
		Range: 1-65536		
ANALOG AUDIO CHANNEL INPUT RIGHT	R-x\ASI\ASR-n	Allowed when: R\CDT is "VIDIN"		Indicate the analog channel source of the right audio channel ID for the video channel.
		Range: 1-65536		
VIDEO DATA ALIGNMENT	R-x\VDA-n	R/R Ch 10 Status: RO		Specify the data alignment of the video data within the packet.
		Allowed when: R\CDT is "VIDIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		L	Little endian	
		B	Big endian	
Time Data Type Attributes				
TIME DATA TYPE FORMAT	R-x\TTF-n	R/R Ch 10 Status: R		Time data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "TIMEIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Reserved	
		1	Time data	
		2	Network time	
TIME FORMAT	R-x\TFMT-n	R/R Ch 10 Status: R		
		Allowed when: R\CDT is "TIMEIN"		
		Range: Enumeration		

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		Enumeration	Description	Indicate the format for the time. For additional information, see RCC 200-04.[1] y is an optional last digit.
		A	IRIG-A 1xy	
		B	IRIG-B 1xy	
		G	IRIG-G 1xy	
		I	Internal	
		N	Native GPS time	
		U	UTC time from GPS	
		X	None	
CHANGE		0	Network Time Protocol Version 3 RFC-1305	
		1	IEEE Std 1588-2002	
		2	IEEE Std 1588-2008	
		Default: A		
TIME SOURCE	R-x\TSRC-n	R/R Ch 10 Status: R		Indicate the time source.
		Allowed when: R\CDT is "TIMEIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		I	Internal	
		E	External	
		R	Internal from RMM	
		X	None	
Image Data Type Attributes				
IMAGE DATA TYPE FORMAT	R-x\ITF-n	R/R Ch 10 Status: RO		Image data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "IMGIN"		
		Required when: Allowed		

[1] Range Commanders Council. "IRIG Serial Time Code Formats." RCC 200-04. May be superseded by update. Retrieved 4 June 2015. Available at http://www.wsmr.army.mil/RCCsite/Documents/200-04_IRIG%20Serial%20Time%20Code%20Formats/.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		Range: Enumeration		
		Enumeration	Description	
		0	Image	
		1	Still imagery	
		2	Dynamic imagery	
STILL IMAGE TYPE	R-x\SIT-n	R/R Ch 10 Status: RO		Type of still imagery format.
		Allowed when: R\CDT is “IMGIN”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	NITF	
		1	JPEG	
		2	JPEG2	
		3	PNG	
DYNAMIC IMAGE FORMAT	R-x\DIF-n	R/R Ch 10 Status: RO		Type of dynamic imagery format IAW Genicam standard features naming convention v1.5 or later and GigE Vision v1.2 or later.
		Allowed when: R\CDT is “IMGIN”		
		Required when: Allowed		
		Range: Enumeration		
		(Permitted enumerated values are per standards referenced in the Definition column or the word DEVICESPECIFIC for any imagery format not referenced by those standards.)		
IMAGE TIME STAMP MODE	R-x\ITSM-n	R/R Ch 10 Status: RO		Individual image time stamp mode.
		Allowed when: R\CDT is “IMGIN”		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Image capture time	
		1	Image packetization time	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
DYNAMIC IMAGE ACQUISITION MODE	R-x\DIAM-n	R/R Ch 10 Status: RO		Dynamic image acquisition mode. "0" (Single frame). "1" (Multi-frame). "2" (Continuous).
		Allowed when: R\CDT is "IMGIN"		
IMAGE FRAME RATE	R-x\IFR-n	R/R Ch 10 Status: RO		Frame rate in frames per second at which the frames are captured or streamed in continuous mode.
		Required when: Allowed		
		Range: positive floating point		
PRE-TRIGGER FRAMES	R-x\PTG-n	Allowed when: R\CDT is "IMGIN"		Number of frames to capture before acquisition trigger.
		Range: positive floating point		
TOTAL FRAMES	R-x\TOTF-n	Allowed when: R\CDT is "IMGIN"		Total number of frames to be captured including pre-trigger frames.
		Range: positive floating point		
EXPOSURE TIME	R-x\EXP-n	Allowed when: R\CDT is "IMGIN"		Image exposure time in microseconds including fractional seconds if desired.
		Range: positive floating point		
SENSOR ROTATION	R-x\ROT-n	Allowed when: R\CDT is "IMGIN"		Sensor rotation 0-359.
		Range: 0-359		
SENSOR GAIN VALUE	R-x\SGV-n	Allowed when: R\CDT is "IMGIN"		Sensor gain value in dB.
		Range: floating point		
SENSOR AUTO GAIN	R-x\SAG-n	Allowed when: R\CDT is "IMGIN"		Sensor auto gain.
		Range: Enumeration		
		Enumeration	Description	
		0	Off	
		1	On	
SENSOR WIDTH	R-x\ISW-n	R/R Ch 10 Status: RO		Effective sensor width in pixels used to capture images.
		Allowed when: R\CDT is "IMGIN"		
		Required when: Allowed		
		Range:1-9999999		
SENSOR HEIGHT	R-x\ISH-n	R/R Ch 10 Status: RO		Effective sensor height in pixels used to capture images.
		Allowed when: R\CDT is "IMGIN"		
		Required when: Allowed		
		Range: 1-9999999		

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
MAXIMUM IMAGE WIDTH	R-x\MIW-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: 1-9999999	Maximum image width in pixels.
MAXIMUM IMAGE HEIGHT	R-x\MIH-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: Integer, 1-9999999	Maximum image height in pixels.
IMAGE WIDTH	R-x\IW-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: 1-9999999	Image width in pixels.
IMAGE HEIGHT	R-x\IH-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: 1-9999999	Image height in pixels.
IMAGE OFFSET X	R-x\IOX-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: 1-9999999	Image horizontal offset from origin to area of interest in pixels.
IMAGE OFFSET Y	R-x\IOY-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "IMGIN" Required when: Allowed Range: 1-9999999	Image vertical offset from origin to area of interest in pixels.
LINE PITCH	R-x\ILP-n	Allowed when: R\CDT is "IMGIN" Range: 1-999999999	Total number of bytes between two successive lines.
BINNING HORIZONTAL	R-x\IBH-n	Allowed when: R\CDT is "IMGIN" Range: 1-9999999	Number of horizontal photo-sensitive cells to combine together. A value of 1 indicates no horizontal binning.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
BINNING VERTICAL	R-x\IBV-n	Allowed when: R\CDT is "IMGIN"		Number of vertical photo-sensitive cells to combine together. A value of 1 indicates no vertical binning.
		Range: 1-9999999		
DECIMATION HORIZONTAL	R-x\IDH-n	Allowed when: R\CDT is "IMGIN"		Horizontal sub-sampling of the image. A value of 1 indicates no horizontal decimation.
		Range: 1-9999999		
DECIMATION VERTICAL	R-x\IDV-n	Allowed when: R\CDT is "IMGIN"		Vertical sub-sampling of the image. A value of 1 indicates no vertical decimation.
		Range: 1-9999999		
REVERSE X	R-x\IRX-n	Allowed when: R\CDT is "IMGIN"		Flip horizontally the image sent by the device. "T" (True). "F" (False).
		Range: Enumeration		
REVERSE Y	R-x\IRY-n	Allowed when: R\CDT is "IMGIN"		Flip vertically the image sent by the device.
		Range: Enumeration		
		Enumeration	Description	
		T	True	
		F	False	
PIXEL DYNAMIC RANGE MINIMUM	R-x\IPMN-n	Allowed when: R\CDT is "IMGIN"		Minimum value that can be returned during the digitization process.
		Range: 1-9999999		
PIXEL DYNAMIC RANGE MAXIMUM	R-x\IPMX-n	Allowed when: R\CDT is "IMGIN"		Maximum value that can be returned during the digitization process.
		Range: 1-9999999		
TEST IMAGE TYPE	R-x\TIT-n	Allowed when: R\CDT is "IMGIN"		Type of test image sent by the camera.
		Range: Enumeration		
		Enumeration		
		OFF		
		BLACK		
		WHITE		
		GREYHORIZONTALRAMP		
		GREYVERTICALRAMP		
		GREYHORIZONTALRAMPMOVING		

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		GREYVERTICALRAMPMOVING	
		HORIZONTALLINEMOVING	
		VERTICALLINEMOVING	
		COLORBAR	
		FRAMECOUNTER	
		DEVICESPECIFIC	
UART Data Type Attributes			
UART DATA TYPE FORMAT	R-x\UTF-n	R/R Ch 10 Status: RO	UART data type format.
		Allowed when: R\CDT is "UARTIN"	
		Required when: Allowed	
		Range: Enumeration	
		Enumeration: 0 — Description: Format 0	
		Enumeration: 1 — Description: Format 1	
NUMBER OF UART SUB-CHANNELS	R-x\NUS\N-n	R/R Ch 10 Status: RO	Specify the number of UART sub-channels included within this channel.
		Allowed when: R\CDT is "UARTIN"	
		Required when: Allowed	
		Range: 1-256	
UART SUB-CHANNEL NUMBER	R-x\USCN-n-m	R/R Ch 10 Status: RO	Specify the UART sub-channel number. First sub-channel is 1.
		Allowed when: R\NUS\N > 0	
		Required when: Allowed	
		Range: 1-256	
UART SUB-CHANNEL NAME	R-x\UCNM-n-m	R/R Ch 10 Status: RO	Specify the UART sub-channel name.
		Allowed when: R\NUS\N > 0	
		Required when: Allowed	
		Range: 32 characters	
UART SUB-CHANNEL BAUD RATE	R-x\UCR-n-m	R/R Ch 10 Status: RO	Baud rate in bits per second.
		Allowed when: R\NUS\N > 0	
		Required when: Allowed	

Table 9-4. Recorder-Reproducer Attributes Group (R)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Range: positive floating point		
UART SUB-CHANNEL BITS PER WORD	R-x\UCB-n-m	R/R Ch 10 Status: RO		Bits per word (7, 8, or 9).
		Allowed when: R\NUS\N > 0		
		Required when: Allowed		
		Range: 7, 8, or 9		
UART SUB-CHANNEL PARITY	R-x\UCP-n-m	R/R Ch 10 Status: RO		
		Allowed when: R\NUS\N > 0		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		O	Odd	
		E	Even	
		N	None	
UART SUB-CHANNEL STOP BIT	R-x\UCS-n-m	R/R Ch 10 Status: RO		Stop bit size.
		Allowed when: R\NUS\N > 0		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	1.0	
		1	1.5	
		2	2.0	
UART SUB-CHANNEL INTERFACE	R-x\UCIN-n-m	Allowed when: R\NUS\N > 0		UART interface.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Other	
		1	RS-232	
		2	RS-422	
		3	RS-485	

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		4 TTL	
UART SUB-CHANNEL BLOCK SIZE	R-x\UCBS-n-m	Allowed when: R\NUS\N > 0 Required when: Allowed Range: Integer, 0-999999	Block (frame) size in words.
CHANGE UART SUB-CHANNEL SYNC WORD LENGTH	R-x\UCSL-n-m	Allowed when: R\UCBS > 1 Required when: Allowed Range: 0-9	Sync word length in words.
CHANGE UART SUB-CHANNEL BLOCK SYNC VALUE	R-x\UCSV-n-m	Allowed when: R\UCBS > 1 Required when: Allowed Range: Binary, 81 binary digits	Block sync word value in binary. Specify all bits.
CHANGE UART SUB-CHANNEL BLOCK RATE	R-x\UCBR-n-m	Allowed when: R\NUS\N > 0 Range: positive floating point	Block rate in Hz
Message Data Type Attributes			
MESSAGE DATA TYPE FORMAT	R-x\MTF-n	R/R Ch 10 Status: RO Allowed when: R\CDT is “MSGIN” Required when: Allowed Range: Enumeration Enumeration: 0 — Description: message data	Message data type format. Enumeration equates to format number in Chapter 10.
NUMBER OF MESSAGE SUB-CHANNELS	R-x\NMS\N-n	R/R Ch 10 Status: RO Allowed when: R\CDT is “MSGIN” Required when: Allowed Range: 1-256	Specify the number of message sub-channels included within this channel.
MESSAGE SUB-CHANNEL NUMBER	R-x\MSCN-n-m	R/R Ch 10 Status: RO Allowed when: R\NMS\N > 0 Required when: Allowed Range: Integer, 1-256	Specify the message sub-channel number. The first sub-channel is 1.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
MESSAGE SUB-CHANNEL NAME	R-x\MCNM-n-m	R/R Ch 10 Status: RO		Specify the message sub-channel name.
		Allowed when: R\NMS\N > 0		
		Required when: Allowed		
		Range: 32 characters		
IEEE-1394 Data Type Attributes				
IEEE-1394 DATA TYPE FORMAT	R-x\IETF-n	R/R Ch 10 Status: RO		IEEE-1394 data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "1394IN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	IEEE-1394 TRANS	
		1	IEEE-1394 PHY	
Parallel Data Type Attributes				
PARALLEL DATA TYPE FORMAT	R-x\PLTF-n	R/R Ch 10 Status: RO		Parallel data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "PARIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Parallel	
Ethernet Data Type Attributes				
ETHERNET DATA TYPE FORMAT	R-x\ENTF-n	R/R Ch 10 Status: RO		Ethernet data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "ETHIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	Ethernet data	

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
NUMBER OF ETHERNET NETWORKS	R-x\NNET\N-n	R/R Ch 10 Status: RO		Specify the number of Ethernet networks included within this channel.
		Allowed when: R\CDT is "ETHIN"		
		Required when: Allowed		
		Range: 1-256		
ETHERNET NETWORK NUMBER	R-x\ENBR-n-m	R/R Ch 10 Status: RO		Specify the Ethernet network number. The first network number is 1.
		Allowed when: R\NNET\N > 0		
		Required when: Allowed		
		Range: Integer, 1-256		
ETHERNET NETWORK NAME	R-x\ENAM-n-m	R/R Ch 10 Status: RO		Specify the Ethernet network name.
		Allowed when: R\NNET\N > 0		
		Required when: Allowed		
		Range: 32 characters		
TSPI/CTS Data Type Attributes				
TSPI/CTS DATA TYPE FORMAT	R-x\TDTF-n	R/R Ch 10 Status: RO		TSPI/CTS data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "TSPIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	NMEA-RTCM	
		1	EAG ACMI	
		2	ACTTS	
CAN Bus Data Type Attributes				
CAN BUS DATA TYPE FORMAT	R-x\CBTF-n	R/R Ch 10 Status: RO		CAN bus data type format. Enumeration equates to format number in Chapter 10.
		Allowed when: R\CDT is "CANIN"		
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		0	CAN bus	

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
NUMBER OF CAN BUS SUB-CHANNELS	R-x\NCB\N-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "CANIN" Required when: Allowed Range: 1-256	Specify the number of CAN bus sub-channels in the packet.
CAN BUS SUB-CHANNEL NUMBER	R-x\CBN-n-m	R/R Ch 10 Status: RO Allowed when: R\NCB\N > 0 Required when: Allowed Range: 1-256	Specify the CAN bus sub-channel ID. First sub-channel is 1.
CAN BUS SUB-CHANNEL NAME	R-x\CBM-n-m	R/R Ch 10 Status: RO Allowed when: R\NCB\N > 0 Required when: Allowed Range: 32 characters	Specify the CAN bus sub-channel name.
CAN BUS BIT RATE	R-x\CBBS-n-m	R/R Ch 10 Status: RO Allowed when: R\NCB\N > 0 Required when: Allowed Range: 1-256	Specify the bit rate of the CAN bus sub-channel in bits per second.
Fibre Channel Data Type Attributes			
FIBRE CHANNEL DATA TYPE FORMAT	R-x\FCTF-n	R/R Ch 10 Status: RO Allowed when: R\CDT is "FBCHIN" Required when: Allowed Range: Enumeration Enumeration — Description 0 — FC-PH 1 — FC-FS	Fibre Channel data type format
FIBRE CHANNEL SPEED	R-x\FCSP-n	* R/R Ch 10 Status: RO Allowed when: R\CDT is "FBCHIN" Required when: Allowed Range: Enumeration Enumeration — Description	Fibre Channel speed (bit rate) for the port for frame capture.

Table 9-4. Recorder-Reproducer Attributes Group (R)

Parameter	Code Name	Usage Attributes		Definition
		0	1GFC (1.0625 gigabits per second [Gbps])	
		1	2GFC (2.125 Gbps)	
		2	4GFC (4.25 Gbps)	
		3	8GFC (8.5 Gbps)	
		4	10GFC (10.52 Gbps)	
		5	16GFC (14.025 Gbps)	
		6	32GFC (28.05 Gbps)	
Telemetry Output				
OUTPUT STREAM NAME	R-x\OSNM-n	Allowed when: R\CDT is "TMOUT"		Specify the recorder-reproducer channel group stream name to be included in the telemetry output.
		Required when: Allowed		
		Links to: R-x\CGNM-n		
		Range: 32 characters		
STREAM ID	R-x\SID-n	Allowed when: R\CDT is "TMOUT"		Specify the stream ID for the minor frame header unprotected part
		Range: 0-15		
		Default: 0		
CONFIGURATION HASH RATE	R-x\HRATE-n	Allowed when: R\CDT is "TMOUT"		Specify the rate of the Chapter 10 configuration packet hash code insertion into the telemetry output in seconds. Value 0 allows sending once after changes. Use character "N" for disable.
		Range: 0-60, N		
		Default: "N', disabled		
CONFIGURATION PACKET RATE	R-x\CRATE-n	Allowed when: R\CDT is "TMOUT"		Specify the rate of the Chapter 10 configuration packet insertion into the telemetry output in seconds. Value 0 allows sending once after changes. Use character "N" for disable.
		Range: 0-60, N		
		Default: "N', disabled		
Reference Track				
NUMBER OF REFERENCE TRACKS	R-x\RT\N	Allowed when: R\NCB\N > 0		Specify the number of reference tracks.
		Range: 1-9		
TRACK NUMBER	R-x\RT1-n	Allowed when: R\RT\N > 0		State the track location of the reference signal.

Table 9-4. Recorder-Reproducer Attributes Group (R)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Required when: Allowed	
		Range: 1-99	
REFERENCE FREQUENCY	R-x\RT2-n	Allowed when: R\RT\N > 0	Frequency of reference signal, in kHz.
		Required when: Allowed	
		Range: 6 characters	
NOTE: There will be one tape/storage source attributes group for each tape or storage source.			
Comments			
COMMENTS	R-x\COM	R/R Ch 10 Status: RO	Provide the additional information requested or any other information desired.
		Allowed when: R\ID is specified	
		Range: 3200 characters	

9.5.5 Multiplex/Modulation (Mux/Mod) Attributes (M)

The composite baseband waveform is received from the receiver or tape reproducer electronics and is passed to the demultiplexer/demodulator for further processing. Figure 9-5 summarizes the information that is required to continue processing the data. The composite baseband waveform may consist of any number of signals that are modulated directly onto the RF carrier, including a baseband data signal and one or more subcarriers.

The baseband data signal may be PCM or analog data. The PCM data streams must be defined in terms of a data link name. This data link name is unique for each system that contains different data, has a different format, or has a different data rate. The analog measurand is typically converted into engineering units appropriate for the measurand. The measurement name provides the connection to the Data Conversion Attributes group (C).

Subcarriers, both standard and nonstandard, may be part of the baseband composite waveform. These, in turn, may be modulated with PCM or analog data. As with the baseband data signal, these data channels must be defined. Table 9-5 specifies the required information for the data signal attributes.

Figure 9-5. Multiplex/Modulation Attributes Group (M)		Code Name
DATA SOURCE ID - 9-85		(M-x\ID)
9-85	***Composite Signal Structure**	
	SIGNAL STRUCTURE TYPE	(M-x\BB1)
	MODULATION SENSE	(M-x\BB2)
	COMPOSITE LPF BANDWIDTH	(M-x\BB3)
9-85	***Baseband Signal**	
	BASEBAND SIGNAL TYPE	(M-x\BSG1)
	***Low Pass Filter**	
	BANDWIDTH	(M-x\BSF1)
	TYPE	(M-x\BSF2)
9-86	***Baseband Data Link Type**	
	***PCM**	
	OR DATA LINK NAME	(M-x\BB\DLN)
	***Analog**	
	MEASUREMENT NAME	(M-x\BB\MN)
9-87	***Subcarriers**	
	NUMBER OF SUBCARRIERS	(M-x\SCO\N)
	***IRIG Subcarriers**	
	NUMBER OF SCOs	(M-x\SI\N)
	SCO NUMBER	(M-x\SI1-n)
	SCO #n DATA TYPE	(M-x\SI2-n)
	MODULATION SENSE	(M-x\SI3-n)
9-87	***Low Pass Filter**	
	BANDWIDTH	(M-x\SIF1-n)
	TYPE	(M-x\SIF2-n)
9-88	***Data Link Type**	
	***PCM**	

			DATA LINK NAME	(M-x\SI\DLN-n)
		OR	***Analog**	
			MEASUREMENT NAME	(M-x\SI\MN-n)
9-88		OTHER		(M-x\SO)
	REFERENCE CHANNEL			(M-x\RC)
9-89	***Comments**			
		COMMENTS		(M-x\COM)
*Heading Only - No Data Entry				

Table 9-5. Multiplex/Modulation Group (M)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
DATA SOURCE ID	M-x\ID	Allowed when: defining multiplexed data		Data source identification.
		Required when: Allowed		
		Links from: G\DSI-n, T-x\ID		
		Range: 32 characters		
Composite Signal Structure				
SIGNAL STRUCTURE TYPE	M-x\BB1	Allowed when: M\ID is specified		Specify the composite baseband signal structure.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		PCM		
		ANALOG		
		SCO’s		
		OTHER		
		ANA/SCO	Hybrid	
		PCM/SCO	Hybrid	
MODULATION SENSE	M-x\BB2	Allowed when: M\ID is specified		Specify the modulation sense: “POS” - indicates that an increasing voltage results in an increase in frequency. “NEG” - indicates that a decreasing voltage results in an increase in frequency.
		Range: Enumeration		
		Enumeration	Description	
		POS		
		NEG		
COMPOSITE LPF BANDWIDTH	M-x\BB3	Allowed when: M\ID is specified		Give the low pass bandwidth of the composite waveform (3 dB cutoff frequency), in kHz.
		Range: 6 characters		
Baseband Signal				
BASEBAND SIGNAL TYPE	M-x\BSG1	Allowed when: M\BB1 is not “SCO's” or “OTHER'		Type of baseband data.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		PCM		

Table 9-5. Multiplex/Modulation Group (M)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		ANA	Analog	
		OTH	Other	
		NON	None	
Low-Pass Filter				
BANDWIDTH	M-x\BSF1	Allowed when: defining multiplexed data		Specify low pass filter bandwidth (3 dB cutoff frequency), in kHz.
		Range: 6 characters		
TYPE	M-x\BSF2	Allowed when: defining multiplexed data		Specify the filter type.
		Range: Enumeration		
		Enumeration	Description	
		CA	Constant amplitude	
		CD	Constant delay	
		OT	Other, define in the comments	
Baseband Data Link Type				
PCM				
DATA LINK NAME	M-x\BB\DLN	Allowed when: M\BB1 is not “SCO's' or “OTHER” and M\BSG1 is “PCM”		Specify the data link name for PCM data format.
		Required When: Allowed		
		Links to: P-d\DLN		
		Range: 32 characters		
Analog				
MEASUREMENT NAME	M-x\BB\MN	Allowed when: M\BB1 is not “SCO's” or “OTHER” and M\BSG1 is “ANA”		Give the measurand name.
		Required When: Allowed		
		Links to: C-d\DCN		
		Range: 32 characters		

Table 9-5. Multiplex/Modulation Group (M)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
Subcarriers				
NUMBER OF SUBCARRIERS	M-x\SCO\N	Allowed when: M\BB1 not “PCM” or “ANALOG”		Specify the number of subcarriers on this data link.
		Required when: Allowed		
		Range: 2 characters		
IRIG Subcarriers				
NUMBER OF SCOS	M-x\SI\N	Allowed when: M\BB1 is “SCO's” or “ANA/SCO” or “PCM/SCO”		Specify the number of IRIG subcarriers.
		Required when: Allowed		
		Range: 2 characters		
SCO NUMBER	M-x\SI1-n	Allowed when: M\SI\N > 0		Give the IRIG channel number for the subcarrier.
		Required when: Allowed		
		Range: 5 characters		
SCO #N DATA TYPE	M-x\SI2-n	Allowed when: M\SI\N > 0		Specify the type of data on the subcarrier.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		PCM		
		ANA	Analog	
		OTH	Other	
MODULATION SENSE	M-x\SI3-n	Allowed when: M\SI\N > 0		Specify the modulation sense: “POS” - indicates that an increasing voltage results in an increase in frequency. “NEG” - indicates that a decreasing voltage results in an increase in frequency.
		Range: Enumeration		
		Enumeration	Description	
		POS		
		NEG		
Low-Pass Filter				
BANDWIDTH	M-x\SIF1-n	Allowed when: M\ID is specified		Specify the low pass filter cutoff frequency (3 dB), in kHz.
		Range: 6 characters		
TYPE	M-x\SIF2-n	Allowed when: M\ID is specified		Specify the filter type.

Table 9-5. Multiplex/Modulation Group (M)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Range: Enumeration Enumeration: CA — Constant amplitude Enumeration: CD — Constant delay Enumeration: OT — Other, define in the comments	
Data Link Type			
PCM			
DATA LINK NAME	M-x\SI\DLN-n	Allowed when: M\BB1 is not "PCM" or "ANALOG" and M\SI2 is "PCM" Required when: Allowed Links to: P-d\DLN Range: 32 characters	Specify the data link name for PCM data formats.
Analog			
MEASUREMENT NAME	M-x\SI\MN-n	Allowed when: M\BB1 is not "PCM" or "ANALOG" and M\SI2 is "ANA" Required when: Allowed Links to: C-d\DCN Range: 32 characters	Give the measurand name.
NOTE: Repeat the above for each IRIG subcarrier on this carrier.			
OTHER	M-x\SO	Allowed when: M\ID is specified Range: Enumeration Enumeration: Y — Yes Enumeration: N — No Default: N	Are there nonstandard subcarriers? Define in the comments.
REFERENCE CHANNEL	M-x\RC	Allowed when: M\ID is specified Range: 6 characters	Frequency of reference channel in kHz, if applicable.

Table 9-5. Multiplex/Modulation Group (M)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Comments			
COMMENTS	M-x\COM	Allowed when: M\ID is specified Range: 3200 characters	Provide the additional information requested or any other information desired.

9.5.6 Digital Data Attributes (P, D, B, S)

The digital data attributes are separated into four groups containing PCM-related attribute information. The PCM Format Attributes group (P) is described in item a below. The PCM Measurement Description Attributes, contained in (D), are described in item b. Item c depicts the MIL-STD-1553 or ARINC 429 Bus Data Attributes (B). Item d describes the Message Data Attributes (S).

a. PCM Format Attributes (P). The PCM Format Attributes group contains the information required to decommutate the PCM data stream. Operations of both Class I and Class II are included. Limited information is incorporated for class II operations. Figure 9-6 presents the flow and summary of the information required. In general, only standard methods of synchronization have been included except for cases where considerable application is already in place. Inclusion should not be taken to mean that the nonstandard approaches are better or desired. Table 9-6 contains the PCM Format Attributes. The group defines and specifies the frame format and the information necessary to set up the PCM decommutation. Refer to Chapter 4 for the definition of terms (such as major and minor frames and subframes) and word numbering conventions.

Figure 9-6. PCM Format Attributes Group (P)				Code Name
DATA LINK NAME - 9-93				(P-d\DLN)
9-93	***Input Data**			
		PCM CODE		(P-d\D1)
		BIT RATE		(P-d\D2)
		ENCRYPTED		(P-d\D3)
		POLARITY		(P-d\D4)
		AUTO-POLARITY CORRECTION		(P-d\D5)
		DATA DIRECTION		(P-d\D6)
		DATA RANDOMIZED		(P-d\D7)
		RANDOMIZER LENGTH		(P-d\D8)
9-95	***Format**			
		TYPE FORMAT		(P-d\TF)
			COMMON WORD LENGTH	(P-d\F1)
			WORD TRANSFER ORDER	(P-d\F2)
			PARITY	(P-d\F3)
			PARITY TRANSFER ORDER	(P-d\F4)
			CRC	(P-d\CRC)
			CRC CHECK WORD STARTING BIT	(P-d\CRCCB)
			CRC DATA START BIT	(P-d\CRCDB)
			CRC DATA NUMBER OF BITS	(P-d\CRCDN)
9-97		***Minor Frame**		
			NUMBER OF MINOR FRAMES IN MAJOR FRAME	(P-d\MF\N)
				NUMBER OF WORDS IN A MINOR FRAME (P-d\MF1)
				NUMBER OF BITS IN A MINOR FRAME (P-d\MF2)
			SYNC TYPE	(P-d\MF3)
9-98			***Synchronization Pattern**	

			LENGTH	(P-d\MF4)
			PATTERN	(P-d\MF5)
9-98	***Synchronization Criteria**			
	IN SYNC CRITERIA			(P-d\SYNC1)
		SYNC PATTERN CRITERIA		(P-d\SYNC2)
9-99	***Out of Synchronization Criteria**			
		NUMBER OF DISAGREES		(P-d\SYNC3)
		SYNC PATTERN CRITERIA		(P-d\SYNC4)
		FILL BITS		(P-d\SYNC5)
9-99	***Minor Frame Format Definition**			
	NUMBER OF UNIQUE WORD SIZES			(P-d\MFW\N)
CHANGE		WORD NUMBER		(P-d\MFW1-n)
		NUMBER OF BITS IN WORD		(P-d\MFW2-n)
9-100	***Subframe Synchronization**			
		NUMBER OF SUBFRAME ID COUNTERS		(P-d\ISF\N)
		SUBFRAME ID COUNTER NAME		(P-d\ISF1-n)
		SUBFRAME SYNC TYPE		(P-d\ISF2-n)
9-100		***ID Counter**		
			SUBFRAME ID COUNTER LOCATION	(P-d\IDC1-n)
9-101			ID COUNTER MSB STARTING BIT LOCATION	(P-d\IDC3-n)
			ID COUNTER LENGTH	(P-d\IDC4-n)
			ID COUNTER TRANSFER ORDER	(P-d\IDC5-n)
			ID COUNTER INITIAL VALUE	(P-d\IDC6-n)
			INITIAL COUNT MINOR FRAME NUMBER	(P-d\IDC7-n)
			ID COUNTER END VALUE	(P-d\IDC8-n)
			END COUNT MINOR FRAME NUMBER	(P-d\IDC9-n)
			COUNT DIRECTION	(P-d\IDC10-n)
9-102	***Asynchronous Embedded Format**			
		NUMBER OF ASYNCHRONOUS EMBEDDED FORMATS		(P-d\AEF\N)
			DATA LINK NAME	(P-d\AEF\DLN-n)
			SUPERCOM	(P-d\AEF1-n)
			LOCATION DEFINITION	(P-d\AEF2-n)
			LOCATION	(P-d\AEF3-n-w)
			INTERVAL	(P-d\AEF4-n)
			WORD LENGTH	(P-d\AEF5-n-w)
			MASK	(P-d\AEF6-n-w)
			SUBCOMMUTATED	(P-d\AEF7-n-w)
CHANGE			START FRAME	(P-d\AEF8-n-w-m)
			FRAME INTERVAL	(P-d\AEF9-n-w-m)
9-104	***Format Change**			
		***Frame Format Identifier**		
			LOCATION	(P-d\FFI1)

			MASK	(P-d\FFI2)
9-104		***Measurement List Change**		
			NUMBER OF MEASUREMENT LISTS	(P-d\MLC\N)
			FFI PATTERN	(P-d\MLC1-n)
			MEASUREMENT LIST NAME	(P-d\MLC2-n)
9-105	OR	***Format Structure Change**		
			NUMBER OF FORMATS	(P-d\FSC\N)
			FFI PATTERN	(P-d\FSC1-n)
			DATA LINK ID	(P-d\FSC2-n)
9-105		***Alternate Tag And Data**		
			NUMBER OF TAGS	(P-d\ALT\N)
			NUMBER OF BITS IN TAG	(P-d\ALT1)
			NUMBER OF BITS IN DATA WORD	(P-d\ALT2)
			FIRST TAG LOCATION	(P-d\ALT3)
			SEQUENCE	(P-d\ALT4)
9-106		***Asynchronous Data Merge Format**		
			NUMBER OF ASYNCHRONOUS DATA MERGE FORMATS	(P-d\ADM\N)
			DATA MERGE NAME	(P-d\ADM\DMN-n)
			MASK AND PATTERN	(P-d\ADM\MP-n)
			OVERHEAD MASK	(P-d\ADM\OHM-n)
			FRESH DATA PATTERN	(P-d\ADM\FDP-n)
			DATA OVERFLOW PATTERN	(P-d\ADM\DOP-n)
			STALE DATA PATTERN	(P-d\ADM\SDP-n)
			USER DEFINED PATTERN	(P-d\ADM\UDP-n)
			SUPERCOM	(P-d\ADM1-n)
			LOCATION DEFINITION	(P-d\ADM2-n)
			LOCATION	(P-d\ADM3-n-w)
			INTERVAL	(P-d\ADM4-n)
			DATA LENGTH	(P-d\ADM5-n)
			MSB LOCATION	(P-d\ADM6-n)
			PARITY	(P-d\ADM7-n)
CHANGE			SUBCOMMUTATED	(P-d\ADM8-n-w)
			START FRAME	(P-d\ADM9-n-w-m)
			FRAME INTERVAL	(P-d\ADM10-n-w-m)
NEW 9-109		***Chapter 7 Format**		
			CHAPTER 7 NUMBER OF SEGMENTS	(P-d\C7\N)
			CHAPTER 7 FIRST WORD OF SEGMENT	(P-d\C7FW-n)
			CHAPTER 7 NUMBER OF PCM WORDS IN SEGMENT	(P-d\C7NW-n)
	***Comments**			
9-109		COMMENTS		(P-d\COM)

***Heading Only - No Data Entry**

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
DATA LINK NAME	P-d\DLN	R/R Ch 10 Status: RO Allowed when: defining PCM data Required when: Allowed Links from: M-x\BB\DLN, M-x\SI\DLN-n, R-x\CDLN, P-d\AEF\DLN-n, P-d\FSC2-n, P-d\ADM\DMN-n, R-x\EV\DLN-n Links to: D-x\DLN, B-d\DLN Range: 32 characters	Identify the data link name consistent with the mux/mod group.
Input Data			
PCM CODE	P-d\D1	R/R Ch 10 Status: RO Allowed when: P-d\DLN is specified Range: Enumeration Enumeration — Description: NRZ-L — Non-return-to-zero-level NRZ-M — Non-return-to-zero-mark NRZ-S — Non-return-to-zero-space RNRZ-L — Randomized, non-return-to-zero-level BIO-M — Bi-phase-mark BIO-L — Bi-phase-level BIO-S — Bi-phase-space OTHER — Other encoding, define in comments Default: NRZ-L	Define the data format code. A randomized PCM stream can be specified as: "P-d\D1=NRZ-L" and "P-d\D7=Y"; or "P-d\D1=RNRZ-L" and "P-d\D7" is ignored.
BIT RATE	P-d\D2	R/R Ch 10 Status: RO Allowed when: P-d\DLN is specified Required when: Allowed Range: positive floating point	Data rate in bits per second.
ENCRYPTED	P-d\D3	Allowed when: P-d\DLN is specified	If the data is encrypted, provide details in comments.

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
		Range: Enumeration		
		Enumeration	Description	
		E	Data is encrypted	
		U	Data is unencrypted	
		Default: U		
POLARITY	P-d\D4	R/R Ch 10 Status: RO		Data polarity.
		Allowed when: P-d\DLN is specified		
		Range: Enumeration		
		Enumeration	Description	
		N	Normal	
		I	Inverted	
		Default: N		
AUTO-POLARITY CORRECTION	P-d\D5	Allowed when: P-d\DLN is specified		Is automatic polarity correction to be used?
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
DATA DIRECTION	P-d\D6	Allowed when: P-d\DLN is specified		Time sequence of data.
		Range: Enumeration		
		Enumeration	Description	
		N	Normal	
		R	Reversed	
		Default: N		
DATA RANDOMIZED	P-d\D7	R/R Ch 10 Status: RO		Randomization algorithm is specified in "RANDOMIZER LENGTH" (P-d\D8).
		Allowed when: P-d\DLN is specified		
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	

Table 9-6. PCM Format Attributes Group (P)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		N	No	
		Default: N		
RANDOMIZER LENGTH	P-d\D8	R/R Ch 10 Status: RO		Specify the randomizer length.
		Allowed when: P-d\D7 = Y		
		Range: Enumeration		
		Enumeration	Description	
		STD	15 bits, per Annex A.2	
		OTH	Other, define in comments	
		N/A	Not applicable	
		Default: STD		
Format				
TYPE FORMAT	P-d\TF	R/R Ch 10 Status: RO		Type of PCM format.
		Allowed when: P-d\DLN is specified		
		Range: Enumeration		
		Enumeration	Description	
		ONE	Class I	
		TWO	Class II	
		BUS	1553 bus	
		1553	1553 bus	
		ALTD	Alternate tag and data	
		OTHR	Other, define in comments	
		Default: ONE		
COMMON WORD LENGTH	P-d\F1	R/R Ch 10 Status: RO-PAK		Number of bits in common word length.
		Allowed when: P-d\DLN is specified		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: 4-64		

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
WORD TRANSFER ORDER	P-d\F2	R/R Ch 10 Status: RO-PAK		Define the default for the first bit transferred in normal time sequence.
		Allowed when: P-d\DLN is specified		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: Enumeration		
		Enumeration	Description	
		M	msb	
		L	lsb	
		Default: M		
PARITY	P-d\F3	R/R Ch 10 Status: RO-PAK		Normal word parity.
		Allowed when: P-d\DLN is specified		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default NO		
PARITY TRANSFER ORDER	P-d\F4	Allowed when: P-d\F3 is not NO		Parity bit location.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		L	Leads word	
		T	Trails word	
CRC	P-d\CRC	Allowed when: P-d\DLN is specified		Specify what type of cyclic redundancy code is to be used.
		Range: Enumeration		
		Enumeration	Description	
		A	CRC-16-ANSI	

Table 9-6. PCM Format Attributes Group (P)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		C	CRC-16-CCITT	
		E	CRC-32-ANSI	
		N	None	
		Default: N		
CRC CHECK WORD STARTING BIT	P-d\CRCCB	Allowed when: When P-d\CRC is not N Required when: Allowed Range: 1 to the value of P-d\MF2		The starting bit number in the minor frame where the CRC check word begins. The CRC check word must occupy contiguous bits of the minor frame even if the check word crosses word boundaries. The check word shall always be inserted msb first.
CRC DATA START BIT	P-d\CRCDB	Allowed when: When P-d\CRC is not N Required when: Allowed Range: 1 to the value of P-d\MF2		The starting bit number in the minor frame of the data used in the CRC calculation.
CRC DATA NUMBER OF BITS	P-d\CRCDN	Allowed when: When P-d\CRC is not N Required when: Allowed Range: 1 to the value of P-d\MF2		The number of data bits used in the CRC calculation. The data being checked may span 2 minor frames but is never longer than a single minor frame. Minor frame fill bits are never used as part of a CRC calculation.
Minor Frame				
NUMBER OF MINOR FRAMES IN MAJOR FRAME	P-d\MF\N	R/R Ch 10 Status: RO-PAK Allowed when: P-d\DLN is specified Required when: Allowed and defining CH10 non-throughput mode Range: 1 to 256 Default: 1		Number of minor frames in a major frame.
NUMBER OF WORDS IN A MINOR FRAME	P-d\MF1	R/R Ch 10 Status: RO-PAK Allowed when: P-d\DLN is specified Required when: Allowed and defining CH10 non-throughput mode Range: 2-4096		Specify the number of words in a minor frame, as defined in Chapter 4, Section 4.3 (the minor frame synchronization pattern is always considered as one word, regardless of its length).

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
NUMBER OF BITS IN A MINOR FRAME	P-d\MF2	R/R Ch 10 Status: RO-PAK		Number of bits in a minor frame including minor frame synchronization pattern.
		Allowed when: P-d\DLN is specified		
		Required when: P-d\CRC is not N or defining CH10 non-throughput mode		
		Range: 20 to 16384		
SYNC TYPE	P-d\MF3	Allowed when: P-d\DLN is specified		Define minor frame synchronization type.
		Range: Enumeration		
		Enumeration	Description	
		FPT	Fixed pattern	
		ACC	Alternating Code Complement	
		OTH	Other, define in comments	
		Default: FPT		
Synchronization Pattern				
LENGTH	P-d\MF4	R/R Ch 10 Status: RO-PAK		Specify the minor frame synchronization pattern length in number of bits.
		Allowed when: P-d\DLN is specified		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: 16 to 33		
PATTERN	P-d\MF5	R/R Ch 10 Status: RO-PAK		Define minor frame synchronization pattern in bits (1s and 0s) with the left-most bit as the first bit transmitted. "X" may be used to indicate a "don't care" bit.
		Allowed when: P-d\DLN is specified		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: The value of MF4 count of binary pattern		
Synchronization Criteria				
IN-SYNC CRITERIA	P-d\SYNC1	Allowed when: P-d\DLN is specified		This specifies the desired criteria for declaring the system to be in sync. "0" (First good sync). Number of good sync patterns (1 or greater). "NS" (Not specified).
		Range: 0 to 99 or NS		
		Default: NS		

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
SYNC PATTERN CRITERIA	P-d\SYNC2	Allowed when: P-d\SYNC1 is not NS Required when: Allowed Range: 0 to the value of P-d\MF4	Number of bits that may be in error in the synchronization pattern
Out of Synchronization Criteria			
NUMBER OF DISAGREES	P-d\SYNC3	Allowed when: P-d\DLN is specified Range: 0 to 99 or NS Default: NS	Specify the desired criteria for declaring the system out of sync. Number of bad sync patterns, (1 or greater). "NS" (Not specified).
SYNC PATTERN CRITERIA	P-d\SYNC4	Allowed when: P-d\SYNC3 is not NS Required when: Allowed Range: 0 to the value of P-d\MF4	Number of bits that may be in error in the synchronization pattern.
FILL BITS	P-d\SYNC5	Allowed when: P-d\DLN is specified and defining CH10 non-throughput mode Range: 0-16384 Default: 0	Max number of fill bits between end of frame and next sync pattern that can be ignored.
Minor Frame Format Definition			
NUMBER OF UNIQUE WORD SIZES	P-d\MFW\N	R/R Ch 10 Status: RO-PAK Allowed when: P-d\DLN is specified and words are sized other than the default word size Required when: Allowed and defining CH10 non-throughput mode Range: 0-value of P-d\MF1-1	Count of words that are not the default word size
WORD NUMBER	P-d\MFW1-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\DLN is specified and words are sized other than the default word size Required when: Allowed and defining CH10 non-throughput mode Range: 1-value of P-d\MF1-1	Word position in the minor frame. Word position 1 follows the synchronization pattern.

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes	Definition
NUMBER OF BITS IN WORD	P-d\MFW2-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\MFW1 is specified Required when: Allowed Range: 4-64	The number of bits in word position defined by P-d\MFW1-n. If default value, do not include.
NOTE: The above pair set must be defined for all words that have a length other than the common word length. Therefore, all word positions not included in the above will have the common word length as a default value.			
Subframe Synchronization			
NUMBER OF SUBFRAME ID COUNTERS	P-d\ISF\N	R/R Ch 10 Status: RO-PAK Allowed when: P-d\DLN is specified Range: 0-10 Default: 0	Specify the number of subframe ID counters defined within the minor frame.
SUBFRAME ID COUNTER NAME	P-d\ISF1-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Required when: P-d\ISF\N is greater than 1 Range: 32 characters	Specify the subframe ID counter name.
SUBFRAME SYNC TYPE	P-d\ISF2-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Range: Enumeration Enumeration: ID — ID counter Enumeration: OT — Other, define in comments Default: ID	Define the subframe synchronization type.
ID Counter			
SUBFRAME ID COUNTER LOCATION	P-d\IDC1-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Required when: Allowed and defining CH10 non-throughput mode Range: 1 to value of P-d\MF1-1	If ID counter is designated as the subframe sync type, give the minor frame word position of the counter.

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
ID COUNTER MSB STARTING BIT LOCATION	P-d\IDC3-n	R/R Ch 10 Status: RO-PAK		Specify the bit location of the ID counter msb within the word.
		Allowed when: P-d\ISF\N is greater than 0		
		Required when: Allowed and defining CH10 non-throughput mode		
		Range: 1 to size of word (either P-d\MFW2-n or P-d\F1)		
ID COUNTER LENGTH	P-d\IDC4-n	R/R Ch 10 Status: RO-PAK		Specify the subframe ID counter length, number of bits.
		Allowed when: P-d\ISF\N is greater than 0		
		Required when: Allowed		
		Range: 1 to size of word (either P-d\MFW2-n or P-d\F1)		
ID COUNTER TRANSFER ORDER	P-d\IDC5-n	R/R Ch 10 Status: RO-PAK		Specify whether the msb or lsb is transferred first.
		Allowed when: P-d\ISF\N is greater than 0		
		Range: Enumeration		
		Enumeration	Description	
		M	msb	
		L	lsb	
		D	As specified in WORD TRANSFER ORDER (P-d\F2).	
		Default: D		
ID COUNTER INITIAL VALUE	P-d\IDC6-n	R/R Ch 10 Status: RO-PAK		Specify the initial value of the ID counter.
		Allowed when: P-d\ISF\N is greater than 0		
		Required when: Allowed		
		Range: 0, 1, number of minor frames−1, number of minor frames		
INITIAL COUNT MINOR FRAME NUMBER	P-d\IDC7-n	R/R Ch 10 Status: RO-PAK		Specify the minor frame number associated with the initial count value.
		Allowed when: P-d\ISF\N is greater than 0		
		Range: 1		
		Default: 1		

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
ID COUNTER END VALUE	P-d\IDC8-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Required when: Allowed Range: 0,1,number of minor frames−1, number of minor frames	Specify the end value of the ID counter.
END COUNT MINOR FRAME NUMBER	P-d\IDC9-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Range: Number of minor frames	Specify the minor frame number associated with the end count value.
COUNT DIRECTION	P-d\IDC10-n	R/R Ch 10 Status: RO-PAK Allowed when: P-d\ISF\N is greater than 0 Range: Enumeration Enumeration: INC — Description: Increasing Enumeration: DEC — Description: Decreasing Default: INC	Specify the direction of the count increment.
Asynchronous Embedded Format			
NUMBER OF ASYNCHRONOUS EMBEDDED FORMATS	P-d\AEF\N	Allowed when: P-d\DLN specified Range: 0 to 99 Default: 0	Specify the number of asynchronous embedded formats.
DATA LINK NAME	P-d\AEF\DLN-n	Allowed when: P-d\AEF\N is greater than 0 Required when: Allowed Links to: P-d\DLN Range: 32 characters	Provide the data link name for this asynchronous embedded format. Repeat name and the following entries for the second format, as appropriate. A separate data link definition must be provided for each asynchronous embedded format.
SUPERCOM	P-d\AEF1-n	Allowed when: P-d\AEF\N is greater than 0 Required when: Allowed Range: 1 to P-d\MF1−1 or NO	If the asynchronous format is not supercommutated, enter “NO”. Otherwise, enter the number of host minor frame words that are used.

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
LOCATION DEFINITION	P-d\AEF2-n	Allowed when: P-d\AEF\N is greater than 0		If supercommutated, specify how the word locations are defined.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		F1	First word and interval	
		EL	Every location	
		CW	Contiguous words	
		NA	Not applicable	
LOCATION	P-d\AEF3-n-w	Allowed when: P-d\AEF\N is greater than 0		Specify the first word within the minor frame that contains the asynchronous embedded format identified. For the method when every word location is defined, repeat this entry for each word position applicable. For the first word and interval method, include the next entry to define the interval.
		Required when: Allowed		
		Range: 1 to value of P-d\MF1−1		
INTERVAL	P-d\AEF4-n	Allowed when: P-d\AEF2-n is FI		Specify the interval to be used to define the asynchronous embedded format locations.
		Required when: Allowed		
		Range: 1 to value of P-d\MF1−1		
WORD LENGTH	P-d\AEF5-n-w	Allowed when: P-d\AEF\N is greater than 0		Specify the number of embedded bits in this host word location.
		Required when: Allowed		
		Range: 1 to size of word (either P-d\MFW2−n or P-d\F1)		
MASK	P-d\AEF6-n-w	Allowed when: P-d\AEF\N is greater than 0		If the asynchronous portion of the word is shorter than the word length, then provide the binary mask required to indicate which bits are used (1s used, 0s not used). Left-most bit corresponds to the msb.
		Required when: P-d\AEF5-n-w is not the full word length		
		Range: 1 to size of word (either P-d\MFW2-n or P-d\F1) of 0,1		
SUB-COMMUTATED	P-d\AEF7-n-w	Allowed when: P-d\AEF\N is greater than 0		If this embedded format is not subcommutated (and appears in every minor frame), enter “NO”; otherwise, enter the number of definitions to follow, m.
		Range: 0 to size of minor frame length or NO		
		Default: NO		

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
START FRAME	P-d\AEF8-n-w-m	Allowed when: P-d\AEF7-n-w is not NO Range: 1 to size of minor frame length Default: 1	When the embedded format is subcommutated, enter the first minor frame number this embedded format appears in. If this field is missing, the default value "1" is assumed. Repeat P-d\AEF7-n-w number of times.
FRAME INTERVAL	P-d\AEF9-n-w-m	Allowed when: P-d\AEF7-n-w is not NO Range: 0 to size of minor frame length Default: 1	When the embedded format is subcommutated, enter the interval between minor frames that this embedded format appears in. If this field is missing, the default value "1" is assumed. Repeat P-d\AEF7-n-w number of times.
Format Change			
Frame Format Identifier			
LOCATION	P-d\FFI1	Allowed when: P-d\DLN is specified Range: 1 to value of P-d\MF1−1	Specify the position in the minor frame that contains the frame format identification (FFI) word. If more than one word location, provide the details in the comments.
MASK	P-d\FFI2	Allowed when: P-d\FFI1 is specified Required when: Allowed Range: 1 to size of word (either P-d\MFW2−n or P-d\F1) of 0,1	If the FFI is shorter than the word length, then provide the binary mask required to indicate which bits are used. Leftmost bit corresponds to the msb.
Measurement List Change			
NUMBER OF MEASUREMENT LISTS	P-d\MLC\N	Allowed when: If P-d\FSC\N is 0 Range: 1-99, NO Default: NO	Specify the number of measurement lists that are required to be selected. If none, enter "NO". Otherwise, enter the number, n.
FFI PATTERN	P-d\MLC1-n	Allowed when: P-d\MLC\N is not NO Required when: Allowed Range: Size of 1-Size of word (either P-d\MFW2−n or P-d\F1) of 0,1	Specify the FFI pattern that corresponds to the measurement list (1s and 0s). This entry and the next are an ordered pair.
MEASUREMENT LIST NAME	P-d\MLC2-n	Allowed when: P-d\MLC\N is not NO Required when: Allowed	Specify the measurement list name.

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Links to: D-x\MLN-y	
		Range: 32 characters	
Format Structure Change			
NUMBER OF FORMATS	P-d\FSC\N	Allowed when: P-d\MLC\N is NO	Specify the number of formats to be defined.
		Range: 0-99	
		Default: 0	
FFI PATTERN	P-d\FSC1-n	Allowed when: P-d\FSC\N is specified	Specify the FFI pattern that corresponds to the format that is defined. This entry and the next are an ordered pair.
		Required when: Allowed	
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1	
DATA LINK ID	P-d\FSC2-n	Allowed when: P-d\FSC\N is specified	Identify the format that corresponds to this FFI code.
		Required when: Allowed	
		Links to: P-d\DLN	
		Range: 32 characters	
Alternate Tag And Data			
NUMBER OF TAGS	P-d\ALT\N	Allowed when: P-d\DLN specified	Specify the number of tag/data pairs to be included within the minor frame.
		Range: 0-999	
		Default: 0	
NUMBER OF BITS IN TAG	P-d\ALT1	Allowed when: if P-d\ALT\N is greater than 0	Specify the number of bits that are in the tag.
		Required when: Allowed	
		Range: Range 1-Size of word (P-d\F1)	
NUMBER OF BITS IN DATA WORD	P-d\ALT2	Allowed when: if P-d\ALT\N is greater than 0	Specify the number of bits that are in the common data word.
		Required when: Allowed	
		Range: Range 1-Size of word (P-d\F1)	
FIRST TAG LOCATION	P-d\ALT3	Allowed when: if P-d\ALT\N is greater than 0	Identify the location of the start of the first tag location in terms of bits, with the first bit position after the synchronization pattern being number 1.
		Required when: Allowed	

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
		Range: 1-16384		
SEQUENCE	P-d\ALT4	Allowed when: if P-d\ALT\N is greater than 0		If the tag/data word sequence is tag, then data enter "N" for normal. If the data precedes the tag, enter "R" for reversed.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		N	Normal	
		R	Reversed	
Asynchronous Data Merge Format				
NUMBER OF ASYNCHRONOUS DATA MERGE FORMATS	P-d\ADM\N	Allowed when: P-d\DLN specified		Specify the number of asynchronous data merge formats.
		Range: 0-99		
		Default: 0		
DATA MERGE NAME	P-d\ADM\DMN-n	Allowed when: P-d\ADM\N is not 0		Provide the data merge name for this asynchronous data merge format. This can be used to identify the source of the data merge format, as appropriate. Use the comments field to describe this data source for the asynchronous data merge format.
		Required when: Allowed		
		Links to: P-d\DLN		
		Range: 32 characters		
MASK AND PATTERN	P-d\ADM\MP-n	Allowed when: P-d\ADM\N is not 0		If the asynchronous data merge format uses the overhead bits as recommended in Chapter 4, enter "N". Otherwise enter "Y" and specify the overhead mask and patterns. Default is "N" (Chapter 4).
		Range: Enumeration		
		Enumeration	Description	
		N	No	
		Y	Yes	
		Default: N		
OVERHEAD MASK	P-d\ADM\OHM-n	Allowed when: P-d\ADM\MP-n is Y		If "MASK AND PATTERN" is "Y", provide the mask of the overhead bits in binary. Left-most bit corresponds to the msb.
		Required when: Allowed		
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1		
FRESH DATA PATTERN	P-d\ADM\FDP-n	Allowed when: P-d\ADM\MP-n is Y		If "MASK AND PATTERN" is "Y", provide the pattern for fresh data in binary. Left-most bit
		Required when: Allowed		

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1		corresponds to the msb.
DATA OVERFLOW PATTERN	P-d\ADM\DOP-n	Allowed when: P-d\ADM\MP-n is Y		If "MASK AND PATTERN" is "Y", provide the pattern for data overflow in binary. Left-most bit corresponds to the msb.
		Required when: Allowed		
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1		
STALE DATA PATTERN	P-d\ADM\SDP-n	Allowed when: P-d\ADM\MP-n is Y		If "MASK AND PATTERN" is "Y", provide the pattern for stale data in binary. Left-most bit corresponds to the msb.
		Required when: Allowed		
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1		
USER DEFINED PATTERN	P-d\ADM\UDP-n	Allowed when: P-d\ADM\MP-n is Y		If "MASK AND PATTERN" is "Y", provide the pattern for user defined in binary. Left-most bit corresponds to the msb.
		Required when: Allowed		
		Range: Size of 1-Size of word (either P-d\MFW2-n or P-d\F1) of 0,1		
SUPERCOM	P-d\ADM1-n	Allowed when: P-d\ADM\N is not 0		If the asynchronous data merge format is not super-commutated, enter "NO". Otherwise, enter the number of host minor frame words that are used.
		Required when: Allowed		
		Range: Range of 1-P-d\MF1-1 or NO		
LOCATION DEFINITION	P-d\ADM2-n	Allowed when: P-d\ADM\N is not 0		If supercommutated, specify how the word locations are defined.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		FI	First word and interval	
		EL	Every location	
		CW	Contiguous words	
		NA	Not applicable	
LOCATION	P-d\ADM3-n-w	Allowed when: P-d\ADM\N is not 0		Specify the first word within the minor frame that contains the asynchronous data merge format
		Required when: Allowed		

Table 9-6. PCM Format Attributes Group (P)

Parameter	Code Name	Usage Attributes		Definition
		Range: Range of 1-value of P-d\MF1-1		identified. For the method when every word location is defined, repeat this entry for each word position applicable. For the first word and interval method, include the next entry to define the interval.
INTERVAL	P-d\ADM4-n	Allowed when: If P-d\ADM2-n is FI		Specify the interval to be used to define the asynchronous data merge format locations.
		Required when: Allowed		
		Range: Range of 0-value of P-d\MF1-1		
DATA LENGTH	P-d\ADM5-n	Allowed when: P-d\ADM\N is not 0		Specify the number of data bits used in this data merge format.
		Required when: Allowed		
		Range: 1-Size of word (P-d\F1)		
MSB LOCATION	P-d\ADM6-n	Allowed when: P-d\ADM\N is not 0		Provide the msb position within the host minor frame location.
		Required when: Allowed		
		Range: 1-Size of word (P-d\F1)		
PARITY	P-d\ADM7-n	Allowed when: P-d\ADM\N is not 0		If used, specify the parity information.
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default: NO		
SUB-COMMUTATED	P-d\ADM8-n-w	Allowed when: P-d\ADM\N is not 0		If this data merge format is not subcommutated (and appears in every minor frame), enter “NO”; otherwise, enter the number of definitions to follow, m.
		Range: Range 0-size of subframe, NO		
		Default: NO		
START FRAME	P-d\ADM9-n-w-m	Allowed when: P-d\ADM8-n-w is not NO		When the data merge format is subcommutated, enter the first minor frame number this data merge format appears in. If this field is missing, the default value “1” is assumed. Repeat m number of times.
		Range: 1-size of subframe		
		Default: 1		
FRAME INTERVAL	P-d\ADM10-n-w-m	Allowed when: P-d\ADM8-n-w is not NO		When the data merge format is subcommutated, enter the interval between minor frames that this data merge
		Range: 0-size of subframe		

Table 9-6. PCM Format Attributes Group (P)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Default: 1	format appears in. If this field is missing, the default value "1" is assumed. Repeat m number of times.
Chapter 7 Format			
CHAPTER 7 NUMBER OF SEGMENTS	P-d\C7\N	R/R Ch 10 Status: RO Allowed when: P-d\DLN is specified Required when: Defining a Chapter 7 stream Range: 0 to the value of P-d\MF1-1 Default: 0	If a Chapter 7 stream is defined, specify the number of Chapter 7 segments to be defined.
CHAPTER 7 FIRST WORD OF SEGMENT	P-d\C7FW-n	R/R Ch 10 Status: RO Allowed when: P-d\C7\N is not 0 Required when: Allowed Range: 1 to the value of P-d\MF1-1	Specify the starting PCM word of the Chapter 7 segment. The first transmitted bit of this word is the first bit of the segment.
CHAPTER 7 NUMBER OF PCM WORDS IN SEGMENT	P-d\C7NW-n	R/R Ch 10 Status: RO Allowed when: P-d\C7\N is not 0 Required when: Allowed Range: 1 to the value of P-d\MF1-1	Specify the number of PCM words used that the Chapter 7 segment occupies. An integral, packed number of Chapter 7 bytes is used. Any left-over (0-7) bits are ignored at the end.
Comments			
COMMENTS	P-d\COM	Allowed when: defining PCM Data	Provide the additional information requested or any other information desired.

b. PCM Measurement Description Group (D). Figure 9-7 and Table 9-7 contain the PCM measurement descriptions. The descriptions define each measurand or data item of interest within the frame format specified in the PCM attributes. Table 9-7 includes the measurement name, which links the measurement to the Data Conversion Attributes group.

NOTE	Beginning with RCC IRIG 106-09, it is recommended that the "Word and Frame" location type be used instead of the other six traditional location types. Additionally, when using Word and Frame, it is recommended to avoid the use of subframes (as defined in the Subframe Definitions section of the PCM Format Attributes group in RCC IRIG 106-09 and previous releases) and locate measurements by word number and frame number within the major frame. As of the release of RCC IRIG 106-11, the other six location types and subframes have been removed.

Figure 9-7. PCM Measurement Description Group (D)										Code Name
DATA LINK NAME - 9-112										(D-x\DLN)
	NUMBER OF MEASUREMENT LISTS									(D-x\ML\N)
	MEASUREMENT LIST NAME									(D-x\MLN-y)
	NUMBER OF MEASURANDS									(D-x\MN\N-y)
9-112	MEASUREMENT NAME									(D-x\MN-y-n)
		PARITY								(D-x\MN1-y-n)
		PARITY TRANSFER ORDER								(D-x\MN2-y-n)
		MEASUREMENT TRANSFER ORDER								(D-x\MN3-y-n)
9-113		***Measurement Location**								
			MEASUREMENT LOCATION TYPE							(D-x\LT-y-n)
			***Word And Frame**							
				SUBFRAME ID COUNTER NAME						(D-x\IDCN-y-n)
				NUMBER OF MEASUREMENT LOCATIONS						(D-x\MML\N-y-n)
				NUMBER OF FRAGMENTS						(D-x\MNF\N-y-n-m)
CHANGE				WORD POSITION						(D-x\WP-y-n-m-e)
				WORD INTERVAL						(D-x\WI-y-n-m-e)
9-114				FRAME POSITION						(D-x\FP-y-n-m-e)
				FRAME INTERVAL						(D-x\FI-y-n-m-e)
CHANGE				BIT MASK						(D-x\WFM-y-n-m-e)
				FRAGMENT TRANSFER ORDER						(D-x\WFT-y-n-m-e)
				FRAGMENT POSITION						(D-x\WFP-y-n-m-e)
				***Simultaneous Sampling**						
NEW					SAMPLING MODE					(D-x\SS-y-n)
					SAMPLE ON					(D-x\SON-y-n)
					SAMPLE ON MEASUREMENT NAME					(D-x\SMN-y-n)
					NUMBER OF WORD FRAME SAMPLES					(D-x\SS\N-y-n)
					SAMPLE ON WORD					(D-x\SS1-y-n-s)
					SAMPLE ON FRAME					(D-x\SS2-y-n-s)
	OR		***Tagged Data**							
				NUMBER OF TAG DEFINITIONS						(D-x\TD\N-y-n)

			TAG NUMBER	(D-x\TD2-y-n-m)
			BIT MASK	(D-x\TD3-y-n-m)
			FRAGMENT TRANSFER ORDER	(D-x\TD4-y-n-m)
			FRAGMENT POSITION	(D-x\TD5-y-n-m)
		***Relative**		
			NUMBER OF PARENT MEASUREMENTS	(D-x\REL\N-y-n)
			PARENT MEASUREMENT	(D-x\REL1-y-n-m)
			BIT MASK	(D-x\REL2-y-n-m)
			FRAGMENT TRANSFER ORDER	(D-x\REL3-y-n-m)
			FRAGMENT POSITION	(D-x\REL4-y-n-m)
	***Comments**			
9-118		COMMENTS		(D-x\COM)
***Heading Only - No Data Entry**				

Table 9-7. PCM Measurement Description Group (D)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
DATA LINK NAME	D-x\DLN	Allowed when: P-d\DLN is specified and decommutation is required		Provide the data link name.
		Required when: Allowed and defining CH10 non-throughput mode		
		Links from: P-d\DLN		
		Range: 32 characters		
NUMBER OF MEASUREMENT LISTS	D-x\ML\N	Allowed when: D-x\DLN is specified		Specify the number of measurement lists to be provided.
		Required when: Allowed		
		Range: 1-99		
MEASUREMENT LIST NAME	D-x\MLN-y	Allowed when: D-x\DLN is specified		Provide the measurement list name associated with the following attributes. The following information will have to be repeated for each measurement list identified in the PCM Format Attributes group.
		Required when: Allowed		
		Links from: P-d\MLC2-n		
		Range: 32 characters		
NUMBER OF MEASURANDS	D-x\MN\N-y	Allowed when: D-x\DLN is specified		Specify the number of measurands included within this measurement list.
		Required when: Allowed		
		Range: 1-9999999		
MEASUREMENT NAME	D-x\MN-y-n	Allowed when: D-x\DLN is specified		Measurand name.
		Required when: Allowed		
		Links to: C-d\DCN		
		Links from: D-x\REL1-y-n-m, R-x\SMF\SMN-n-m		
		Range: 32 characters		
PARITY	D-x\MN1-y-n	Allowed when: D-x\DLN is specified		Specify parity.
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	

Table 9-7. PCM Measurement Description Group (D)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		DE	Minor frame default, as specified in PARITY (P-d\F3)	
		Default: DE		
PARITY TRANSFER ORDER	D-x\MN2-y-n	Allowed when: D-x\MN1-y-n is not NO		Parity bit location.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		L	Leads measurement	
		T	Trails measurement	
		D	Minor frame default, as specified in PARITY TRANSFER ORDER (P-d\F4)	
MEASUREMENT TRANSFER ORDER	D-x\MN3-y-n	Allowed when: D-x\DLN specified		Measurement transfer order bit location.
		Range: Enumeration		
		Enumeration	Description	
		M	msb first	
		L	lsb first	
		D	Default, as specified in WORD TRANSFER ORDER, (P-d\F2)	
		Default: D		
Measurement Location				
MEASUREMENT LOCATION TYPE	D-x\LT-y-n	Allowed when: D-x\DLN specified		Specify the nature of the location of this measurand.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		WDFR	Word and frame	
		TD	Tagged data	
		REL	Relative	

Table 9-7. PCM Measurement Description Group (D)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Word And Frame			
SUBFRAME ID COUNTER NAME	D-x\IDCN-y-n	Allowed when: D\LT is "WDFR" Required when: Allowed Range: 32 characters Required condition: When P\ISF\N > 1	Specify the subframe ID counter name (ISF1) that applies to this measurement (needed only if the PCM format contains multiple ID counters).
NUMBER OF MEASUREMENT LOCATIONS	D-x\MML\N-y-n	Allowed when: D\LT is "WDFR" Required when: Allowed Range: 1-9999	Specify the number of location definitions to follow for this measurement.
NUMBER OF FRAGMENTS	D-x\MNF\N-y-n-m	Allowed when: D\LT is "WDFR" Required when: Allowed Range: 1-8	Number of word positions that each fragmented measurement location occupies. Enter "1" if this measurement is not fragmented.
WORD POSITION	D-x\WP-y-n-m-e	Allowed when: D\LT is "WDFR" Required when: Allowed Range: 1 - (P\MF1-1)	Specify the minor frame word position of this measurement location or fragment.
WORD INTERVAL CHANGE	D-x\WI-y-n-m-e	Allowed when: D\LT is "WDFR" Range: 0 - (P\MF1-2) Default: 0	Specify the interval that is the offset from the first word position and each subsequent word position. An interval of zero indicates that there is only one word position being defined.
FRAME POSITION	D-x\FP-y-n-m-e	Allowed when: D\LT is "WDFR" Range: 1 - P\MF\N Default: 1	Specify the frame location of this measurement location or fragment.
FRAME INTERVAL CHANGE	D-x\FI-y-n-m-e	Allowed when: D\LT is "WDFR" Range: 0 - (P\MF\N-1) Default: 0	Specify the interval that is the offset from the first frame location and each subsequent frame location. An interval of zero indicates that there is only one frame location being defined.
BIT MASK	D-x\WFM-y-n-m-e	Allowed when: D\LT is "WDFR" Range: 1-64 of 0,1 or FW Default: FW	Binary string of 1s and 0s to identify the bit locations used in each measurement location or fragment. If the full word is used, enter "FW". Left-most bit corresponds to the msb.

Table 9-7. PCM Measurement Description Group (D)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
FRAGMENT TRANSFER ORDER	D-x\WFT-y-n-m-e	Allowed when: D\MNF\N > 1		Measurement Transfer Order bit location.
		Range: Enumeration		
		Enumeration	Description	
		M	msb first	
		L	lsb first	
		D	Default, as specified in WORD TRANSFER ORDER (P-d\F2)	
		Default: D		
FRAGMENT POSITION	D-x\WFP-y-n-m-e	Allowed when: D\MNF\N > 1		A number from 1 to N specifying the position of this fragment within the reconstructed binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once.
		Range: 1 - D\MNF\N		
		Default: 1		
NOTE: Measurement word length, fragment transfer order, and fragment position attributes do not apply when the "number of fragments" attribute for a measurement is 1.				
Simultaneous Sampling				
SAMPLING MODE	D-x\SS-y-n	Allowed when: D-x\DLN is specified		Specify the sampling mode. Default is Normal.
		Range: Enumeration		
		Enumeration	Description	
		N	Normal	
		SS	Simultaneous Sample	
		Default: N		
SAMPLE ON	D-x\SON-y-n	Allowed when: D-x\SS-y-n is SS		Specify where the Simultaneous Sample occurs in the format. Choices are Measurement Name, Word/Frame, On Minor Frame, or On Major Frame.
		Required when: Allowed		
		Range Enumeration		
		Enumeration	Description	
		MN	Measurement	
		WF	Word/Frame	
		MNF	On Minor Frame	

Table 9-7. PCM Measurement Description Group (D)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		MJF	On Major Frame	
SAMPLE ON MEASUREMENT NAME	D-x\SMN-y-n	Allowed when: When D-x\SON-y-n is MN Required when: Allowed Range: 32 characters		Measurement name for the measurement where the simultaneous sample occurs.
NUMBER OF WORD FRAME SAMPLES	D-x\SS\N-y-n	Allowed when: D-x\SON-y-n is WF Required when: Allowed Range: Integer 0+		Number of Word/Frame pairs to follow.
SAMPLE ON WORD	D-x\SS1-y-n-s	Allowed when: D-x\SON-y-n is WF Required when: Allowed Range: 1 – the value of P\MF1 – 1		Word position where the simultaneous sample occurs.
SAMPLE ON FRAME	D-x\SS2-y-n-s	Allowed when: D-x\SON-y-n is WF Range: 1 –(P\MF\N-1)		Frame position where the simultaneous sample occurs. If not specified, then simultaneous sampling occurs on every minor frame.
Tagged Data				
NUMBER OF TAG DEFINITIONS	D-x\TD\N-y-n	Allowed when: D\LT is “TD” Required when: Allowed Range: 1-9999		Specify the number of tag definitions, N. If not fragmented, enter “1”.
TAG NUMBER	D-x\TD2-y-n-m	Allowed when: D\LT is “TD” Required when: Allowed Range: 1-9999999999		The expected tag number from the input data stream.
BIT MASK	D-x\TD3-y-n-m	Allowed when: D\LT is “TD” Range: 1-64 of 0,1 or FW Default: FW		Binary string of 1s and 0s to identify the bit locations in a word position that are assigned to this tagged data measurement. If the full word is used for this measurement, enter “FW”. Left-most bit corresponds to the msb.
FRAGMENT TRANSFER ORDER	D-x\TD4-y-n-m	Allowed when: D\LT is “TD” Range: Enumeration Enumeration M	Description msb first	Fragment Transfer Order bit location.

Table 9-7. PCM Measurement Description Group (D)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		L	lsb first	
		D	Default, as specified in WORD TRANSFER ORDER (P-d\F2)	
		Default: D		
FRAGMENT POSITION	D-x\TD5-y-n-m	Allowed when: D\LT is "TD"		A number from 1 to N specifying the position of this fragment within the reconstituted binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once.
		Range: 1 - D\TD\N		
		Default: 1		
Relative				
NUMBER OF PARENT MEASUREMENTS	D-x\REL\N-y-n	Allowed when: D\LT is "REL"		Specify the number of parent measurements, N. If not fragmented, enter "1".
		Required when: Allowed		
		Range: 1-9999999		
PARENT MEASUREMENT	D-x\REL1-y-n-m	Allowed when: D\LT is "REL"		If fragmented, all parent measurements must be at same data rate.
		Required when: Allowed		
		Links to: D-x\MN-y-n		
		Range: 32 characters		
BIT MASK	D-x\REL2-y-n-m	Allowed when: D\LT is "REL"		Binary string of 1s and 0s to identify the bit locations in a word position that are assigned to this relative measurement. If the full word is used for this measurement, enter "FW". Leftmost bit corresponds to the msb.
		Range: 1-64 of 0,1 or FW		
		Default: FW		
FRAGMENT TRANSFER ORDER	D-x\REL3-y-n-m	Allowed when: D\LT is "REL"		Fragment Transfer Order bit location.
		Range: Enumeration		
		Enumeration	Description	
		M	msb first	
		L	lsb first	
		D	Default, as specified in WORD TRANSFER ORDER (P-d\F2)	

Table 9-7. PCM Measurement Description Group (D)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
		Default: D	
FRAGMENT POSITION	D-x\REL4-y-n-m	Allowed when: D\LT is "REL" Range: 1-D\REL\N Default: 1	A number from 1 to N specifying the position of this fragment within the reconstituted binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once.
Comments			
COMMENTS	D-x\COM	Allowed when: D-x\DLN specified Range: 3200 characters	Provide the additional information requested or any other information desired.
NOTE: This group will contain a repetition of the above information until each measurement has been defined. Any word position not included will be treated as a spare channel or a "don't care" channel. Information will not be processed for these "spare" channels. Note that measurement list changes and format changes that are a part of class II systems are included in the above, since the key to the measurement definition is the data link name (format) and the measurement list.			

c. Bus Data Attributes (B). Figure 9-8 and Table 9-8 describe bus-originated data formats. The Bus Data Attributes group defines the attributes of a MIL-STD-1553 data acquisition system that is compliant with Chapter 8 or an ARINC 429 data acquisition system that is consistent with the specification of ARINC 429 bus data. The primary components of this group are the recording description and message content definition. The former defines the method by which the data were recorded on the tape such as track spread versus composite. The latter consists of the message identification information and the measurement description set. The message identification information defines the contents of the control word that identifies each bus message. The measurement description set describes the measurement attributes and contains the measurement name that links the measurand to the Data Conversion Attributes group (C).

Mode codes are described in the message identification information. If the Subterminal Address field contains 00000 or 11111, the information in the Data Word Count/Mode Code field is a mode code and identifies the function of the mode code. If the mode code has associated data words, they are described in this section of the attributes. If the bus message is a remote terminal to remote terminal transfer, both the transmit command and the receive command are used to identify the message.

Figure 9-8. Bus Data Attributes Group (B)	Code Name
DATA LINK NAME - 9-121	(B-x\DLN)
TEST ITEM	(B-x\TA)
BUS PARITY	(B-x\BP)
NUMBER OF BUSES	(B-x\NBS\N)
BUS NUMBER	(B-x\BID-i)
BUS NAME	(B-x\BNA-i)
BUS TYPE	(B-x\BT-i)
*** User-Defined Words**	
USER-DEFINED WORD 1 MEASUREMENT	(B-x\UMN1-i)
PARITY	(B-x\U1P-i)
PARITY TRANSFER ORDER	(B-x\U1PT-i)
BIT MASK	(B-x\U1M-i)
TRANSFER ORDER	(B-x\U1T-i)
USER-DEFINED WORD 2 MEASUREMENT	(B-x\UMN2-i)
PARITY	(B-x\U2P-i)
PARITY TRANSFER ORDER	(B-x\U2PT-i)
BIT MASK	(B-x\U2M-i)
TRANSFER ORDER	(B-x\U2T-i)
USER-DEFINED WORD 3 MEASUREMENT	(B-x\UMN3-i)
PARITY	(B-x\U3P-i)
PARITY TRANSFER ORDER	(B-x\U3PT-i)
BIT MASK	(B-x\U3M-i)
TRANSFER ORDER	(B-x\U3T-i)
9-125 ***Recording Description**	
NUMBER OF TRACKS	(B-x\TK\N-i)
TRACK SEQUENCE	(B-x\TS-i-k)
9-125 ***Message Content Definition**	

			NUMBER OF MESSAGES	(B-x\NMS\N-i)
			MESSAGE NUMBER	(B-x\MID-i-n)
			MESSAGE NAME	(B-x\MNA-i-n)
			COMMAND WORD ENTRY	(B-x\CWE-i-n)
			COMMAND WORD	(B-x\CMD-i-n)
			REMOTE TERMINAL NAME	(B-x\TRN-i-n)
			REMOTE TERMINAL ADDRESS	(B-x\TRA-i-n)
			SUBTERMINAL NAME	(B-x\STN-i-n)
			SUBTERMINAL ADDRESS	(B-x\STA-i-n)
			TRANSMIT/RECEIVE MODE	(B-x\TRM-i-n)
			DATA WORD COUNT/MODE CODE	(B-x\DWC-i-n)
			SPECIAL PROCESSING	(B-x\SPR-i-n)
9-127			***ARINC 429 Message Definition**	
			ARINC 429 LABEL	(B-x\LBL-i-n)
			ARINC 429 SDI CODE	(B-x\SDI-i-n)
9-127			***RT/RT Receive Command List**	
			RECEIVE COMMAND WORD ENTRY	(B-x\RCWE-i-n)
			RECEIVE COMMAND WORD	(B-x\RCMD-i-n)
			REMOTE TERMINAL NAME	(B-x\RTRN-i-n)
			REMOTE TERMINAL ADDRESS	(B-x\RTRA-i-n)
			SUBTERMINAL NAME	(B-x\RSTN-i-n)
			SUBTERMINAL ADDRESS	(B-x\RSTA-i-n)
			DATA WORD COUNT	(B-x\RDWC-i-n)
9-128			***Mode Code**	
			MODE CODE DESCRIPTION	(B-x\MCD-i-n)
			MODE CODE DATA WORD DESCRIPTION	(B-x\MCW-i-n)
9-129			***Measurement Description Set**	
			NUMBER OF MEASURANDS	(B-x\MN\N-i-n)
			MEASUREMENT NAME	(B-x\MN-i-n-p)
			MEASUREMENT TYPE	(B-x\MT-i-n-p)
			PARITY	(B-x\MN1-i-n-p)
			PARITY TRANSFER ORDER	(B-x\MN2-i-n-p)
9-130			***Measurement Location**	
			NUMBER OF MEASUREMENT LOCATIONS	(B-x\NML\N-i-n-p)
			MESSAGE WORD NUMBER	(B-x\MWN-i-n-p-e)
9-130			BIT MASK	(B-x\MBM-i-n-p-e)
			TRANSFER ORDER	(B-x\MTO-i-n-p-e)
			FRAGMENT POSITION	(B-x\MFP-i-n-p-e)
	***Comments**			
9-131		COMMENTS		(B-x\COM)

*Heading Only - No Data Entry

Table 9-8. Bus Data Attributes Group (B)

Parameter	Code Name	Usage Attributes		Definition
DATA LINK NAME	B-x\DLN	Allowed when: defining bus data		Identify the data link name consistent with the Multiplex/Modulation group. The PCM format of the data stream shall be defined in the PCM Format Attributes group.
		Required when: Allowed		
		Links from: R-x\CDLN, P-d\DLN, R-x\EV\DLN-n		
		Range: 32 characters		
TEST ITEM	B-x\TA	Allowed when: B\DLN is specified		Test item description in terms of name, model, platform, or identification code that contains the data acquisition system.
		Range: 16 characters		
BUS PARITY	B-x\BP	Allowed when: B\DLN is specified		Specify whether the msb of the 1553 words is a parity bit. If parity is used, it must be odd parity, as specified in Chapter 8, Paragraph 8.2.2.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		OD	Odd	
		NO	None	
NUMBER OF BUSES	B-x\NBS\N	Allowed when: B\DLN is specified		Specify the number of buses included within this data link. If parity is used, the maximum is 8 buses, and if parity is not used, the maximum is 16 buses, as specified in Chapter 8, Paragraph 8.2.3.
		Required when: Allowed		
		Range: 1-16		
BUS NUMBER	B-x\BID-i	Allowed when: B\DLN is specified		Enter the bus number as a binary string.
		Required when: Allowed		
		Range: Binary		
BUS NAME	B-x\BNA-i	Allowed when: B\DLN is specified		Specify the bus name.
		Range: 32 characters		
BUS TYPE	B-x\BT-i	Allowed when: B\DLN is specified		Specify the bus type.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		1553	1553 bus	
		A429	ARINC 429 bus	

Table 9-8. Bus Data Attributes Group (B)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
User-Defined Words			
USER-DEFINED WORD 1 MEASUREMENT	B-x\UMN1-i	Allowed when: defining chapter 8 bus data and using content ID label 0010 Links to: C-d\DCN Range: 32 characters	Specify the measurement name associated with the content ID label (bits 5-8) value of "0010".
PARITY	B-x\U1P-i	Allowed when: B-x\UMN1-i is specified Range: Enumeration Enumeration: Description EV: Even OD: Odd NO: None Default: NO	Specify parity.
PARITY TRANSFER ORDER	B-x\U1PT-i	Allowed when: B\U1P is not "NO" Required when: Allowed Range: Enumeration Enumeration: Description L: Leads word T: Trails word	Parity bit location.
BIT MASK	B-x\U1M-i	Allowed when: B-x\UMN1-i is specified Range: Binary or "FW" Default: FW	Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
TRANSFER ORDER	B-x\U1T-i	Allowed when: B-x\UMN1-i is specified Range: Enumeration Enumeration: Description MSB: msb first LSB: lsb first DEF: Default as specified in WORD TRANSFER ORDER (P-d\F2)	Transfer Order bit location.

Table 9-8. Bus Data Attributes Group (B)

Parameter	Code Name	Usage Attributes		Definition
		Default: MSB		
USER-DEFINED WORD 2 MEASUREMENT	B-x\UMN2-i	Allowed when: defining chapter 8 bus data and using content ID label 0011		Specify the measurement name associated with the content ID label (bits 5-8) value of "0011".
		Links to: C-d\DCN		
		Range: 32 characters		
PARITY	B-x\U2P-i	Allowed when: B-x\UMN2-i is specified		Specify parity.
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default: NO		
PARITY TRANSFER ORDER	B-x\U2PT-i	Allowed when: B\U2P is not "NO"		Parity bit location.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		L	Leads word	
		T	Trails word	
BIT MASK	B-x\U2M-i	Allowed when: B-x\UMN2-i is specified		Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
		Range: Binary or "FW"		
		Default: FW		
TRANSFER ORDER	B-x\U2T-i	Allowed when: B-x\UMN2-i is specified		Transfer Order bit location.
		Range: Enumeration		
		Enumeration	Description	
		MSB	msb first	
		LSB	lsb first	

Table 9-8. Bus Data Attributes Group (B)

Parameter	Code Name	Usage Attributes		Definition
		DEF	Default as specified in WORD TRANSFER ORDER (P-d\F2)	
		Default: MSB		
USER-DEFINED WORD 3 MEASUREMENT	B-x\UMN3-i	Allowed when: defining chapter 8 bus data and using content ID label 0100		Specify the measurement name associated with the content ID label (bits 5-8) value of "0100" (valid only for 1553, when response time is not used).
		Links to: C-d\DCN		
		Range: 32 characters		
PARITY	B-x\U3P-i	Allowed when: B-x\UMN3-i is specified		Specify parity.
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default: NO		
PARITY TRANSFER ORDER	B-x\U3PT-i	Allowed when: B\U3P is not "NO"		Parity bit location.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		L	Leads word	
		T	Trails word	
BIT MASK	B-x\U3M-i	Allowed when: B-x\UMN3-i is specified		Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
		Range: Binary or "FW"		
		Default: FW		
TRANSFER ORDER	B-x\U3T-i	Allowed when: B-x\UMN3-i is specified		Transfer Order bit location.
		Range: Enumeration		
		Enumeration	Description	
		MSB	msb first	

Table 9-8. Bus Data Attributes Group (B)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		LSB	lsb first	
		DEF	Default as specified in WORD TRANSFER ORDER (P-d\F2)	
		Default: MSB		
Recording Description				
NUMBER OF TRACKS	B-x\TK\N-i	Allowed when: B\DLN specified		Enter the number of tape tracks used to record data. Any entry greater than one indicates that the data has been spread across multiple tracks.
		Range: Non-Negative Integer		
		Default: 0		
TRACK SEQUENCE	B-x\TS-i-k	Allowed when: B\TK\N > 1		In these entries, give the sequence order of tape tracks that should be used to recover the data stream in the correct order. The order given should correspond to the actual skew of the data on the tape.
		Required when: Allowed		
		Range: Positive Integer		
Message Content Definition				
NUMBER OF MESSAGES	B-x\NMS\N-i	Allowed when: B\TK\N > 1		The number of messages to be defined.
		Required when: Allowed		
		Range: Positive Integer		
MESSAGE NUMBER	B-x\MID-i-n	Allowed when: B\TK\N > 1		The message number that contains the following data.
		Range: Positive Integer		
MESSAGE NAME	B-x\MNA-i-n	Allowed when: B\TK\N > 1		Specify the message name.
		Range: 32 characters		
COMMAND WORD ENTRY	B-x\CWE-i-n	Allowed when: dB-x\BT-I is 1553		Method used to specify the command word.
		Range: Enumeration		
		Enumeration	Description	
		W	Enter the entire command word in the COMMAND WORD attribute	

Table 9-8. Bus Data Attributes Group (B)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		F	Enter command word fields separately in the REMOTE TERMINAL ADDRESS, SUBTERMINAL ADDRESS, TRANSMIT/RECEIVE MODE, and DATA WORD COUNT/MODE CODE attributes	
		Default: F		
COMMAND WORD	B-x\CMD-i-n	Allowed when: B-x\CWE-i-n is "W"		Specify the entire command word for this message.
		Required when: Allowed		
		Range: Hexadecimal		
REMOTE TERMINAL NAME	B-x\TRN-i-n	Allowed when: B-x\CWE-i-n is "F"		Enter the name of the remote terminal that is sending or receiving this message. For RT/RT, specify the sending remote terminal name.
		Range: 32 characters		
REMOTE TERMINAL ADDRESS	B-x\TRA-i-n	Allowed when: B-x\CWE-i-n is "F"		Specify the five-bit remote terminal address for this message.
		Required when: Allowed		
		Range: Binary		
SUBTERMINAL NAME	B-x\STN-i-n	Allowed when: B-x\CWE-i-n is "F"		Enter the name of the subterminal that is sending or receiving this message.
		Range: 32 characters		
SUBTERMINAL ADDRESS	B-x\STA-i-n	Allowed when: B-x\CWE-i-n is "F"		Specify the five-bit subterminal address for this message. Use "X" to indicate a "don't care" value.
		Required when: Allowed		
		Range: Binary pattern of 5		
TRANSMIT/ RECEIVE MODE	B-x\TRM-i-n	Allowed when: B-x\CWE-i-n is "F"		Indicate if this command word is a transmit or receive command. For RT/RT, specify transmit.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		1	Transmit	
		0	Receive	

Table 9-8. Bus Data Attributes Group (B)

Parameter	Code Name	Usage Attributes		Definition
DATA WORD COUNT/MODE CODE	B-x\DWC-i-n	Allowed when: B-x\CWE-i-n is "F" Required when: Allowed Range: Binary pattern of 5		Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. If the subterminal address indicates a mode code, enter the mode code value as a binary string.
SPECIAL PROCESSING	B-x\SPR-i-n	Allowed when: B\DLN is specified Range: 200 characters		Provide any special processing requirements pertaining to this message.
ARINC 429 Message Definition				
ARINC 429 LABEL	B-x\LBL-i-n	Allowed when: B-x\BT-i is "A429" Required when: Allowed Range: 8 Binary digits		Specify the eight-bit ARINC 429 label for this message.
ARINC 429 SDI CODE	B-x\SDI-i-n	Allowed when: B-x\BT-i is "A429" Required when: Allowed Range: Enumeration		Specify the two-bit ARINC 429 SDI code for this message.
		Enumeration	Description	
		ALL	All SDI	
		0	SDI code 0	
		1	SDI code 1	
		2	SDI code 2	
		3	SDI code 3	
RT/RT Receive Command List				
RECEIVE COMMAND WORD ENTRY	B -x\RCWE-i-n	Allowed when: B\DLN is specified Range: Enumeration		Method used to specify the receive command word. Default is "F".
		Enumeration	Description	
		W	Enter the entire command word in the RECEIVE COMMAND WORD attribute.	

Table 9-8. Bus Data Attributes Group (B)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		F	Enter the command word fields separately in the REMOTE TERMINAL ADDRESS, SUBTERMINAL ADDRESS, and DATA WORD COUNT attributes.	
RECEIVE COMMAND WORD	B-x\RCMD-i-n	Allowed when: B-x\RCWE-i-n is "W" Required when: Allowed Range: Hexadecimal		Specify the entire receive command word for this RT/RT message.
REMOTE TERMINAL NAME	B-x\RTRN-i-n	Allowed when: B-x\RCWE-i-n is "F" Range: 32 characters		Enter the name of the remote terminal that is receiving this RT/RT message.
REMOTE TERMINAL ADDRESS	B-x\RTRA-i-n	Allowed when: B-x\RCWE-i-n is "F" Required when: Allowed Range: Binary		Specify the five-bit remote terminal address for this RT/RT message.
SUBTERMINAL NAME	B-x\RSTN-i-n	Allowed when: B-x\RCWE-i-n is "F" Range: 32 characters		Enter the name of the sub-terminal that is receiving this RT/RT message.
SUBTERMINAL ADDRESS	B-x\RSTA-i-n	Allowed when: B-x\RCWE-i-n is "F" Required when: Allowed Range: Binary Pattern of 5		Specify the five-bit subterminal address for this RT/RT message. Use "X" to indicate a "don't care" value.
DATA WORD COUNT	B-x\RDWC-i-n	Allowed when: B-x\RCWE-i-n is "F" Required when: Allowed Range: Binary Pattern of 5		Enter the number of data words as a binary string, using "X" to indicate a "don't care" value. Exclude status and time words. An RT/RT message cannot contain a mode code.
Mode Code				
MODE CODE DESCRIPTION	B-x\MCD-i-n	Allowed when: B-x\DWC-i-n is 00000 or 11111 Range: 200 characters		Describe the function or action associated with this mode code.
MODE CODE DATA WORD DESCRIPTION	B-x\MCW-i-n	Allowed when: B-x\DWC-i-n is 00000 or 11111 Range: 200 characters		If the mode code has an associated data word following the mode code command, provide a complete description of the data word.

Table 9-8. Bus Data Attributes Group (B)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
Measurement Description Set				
NUMBER OF MEASURANDS	B-x\MN\N-i-n	Allowed when: B\DLN is specified		Specify the number of measurands.
		Required when: Allowed		
		Range: Positive Integer		
MEASUREMENT NAME	B-x\MN-i-n-p	Allowed when: B\DLN is specified		Measurand name.
		Required when: Allowed		
		Links to: C-d\DCN		
		Links from: R-x\BME\SMN-n-m		
		Range: 32 characters		
MEASUREMENT TYPE	B-x\MT-i-n-p	Allowed when: B\DLN is specified		Content identification.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		D	Data word	
		C	Command word	
		S	Status word	
		T	Time word	
PARITY	B-x\MN1-i-n-p	Allowed when: B\DLN is specified		Specify parity.
		Status: Optional		
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default: NO		
PARITY TRANSFER ORDER	B-x\MN2-i-n-p	Allowed when: B\MN1 is not “NO”		Parity bit location.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	

Table 9-8. Bus Data Attributes Group (B)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		L	Leads word	
		T	Trails word	
Measurement Location				
NUMBER OF MEASUREMENT LOCATIONS	B-x\NML\N-i-n-p	Allowed when: B\DLN is specified		If this measurement is contained in one word, enter "1". If this measurement is fragmented, enter the number of fragments.
		Required when: Allowed		
		Range: 1-8		
MESSAGE WORD NUMBER	B-x\MWN-i-n-p-e	Allowed when: B\DLN is specified		Enter the data word number within a message that contains the measurement or the fragmented measurand.
		Required when: Allowed		
		Range: Positive Integer		
BIT MASK	B-x\MBM-i-n-p-e	Allowed when: B\DLN is specified		Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the word identified above. If the full word is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
		Range: Binary or "FW"		
		Default: FW		
TRANSFER ORDER	B-x\MTO-i-n-p-e	Allowed when: B\DLN is specified		Bit transfer order for the measurement.
		Range: Enumeration		
		Enumeration	Description	
		MSB	msb first.	
		LSB	lsb bit first.	
		DEF	Default as specified in WORD TRANSFER ORDER (P-d\F2).	
		Default: MSB		
FRAGMENT POSITION	B-x\MFP-i-n-p-e	Allowed when: B\DLN is specified		A number from 1 to N specifying the position of this fragment within the reconstructed binary data word. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once.
		Range: 1-8		
		Required when: B\NML\N is greater than 1		
NOTE: Repeat the above to describe each fragment of a fragmented word. The transfer order indicates whether to transpose the order of the bit sequence or not (lsb indicates to transpose the bit sequence).				

Table 9-8. Bus Data Attributes Group (B)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Comments			
COMMENTS	B-x\COM	Allowed when: B\DLN is specified Range: 3200 characters	Provide the additional information requested or other information desired.

d. Message Data Attributes (S). The Message Data Attributes are presented graphically in Figure 9-9 and specified in Table 9-9. The information contained within this group is used to describe the characteristics and measurement locations within data streams as described by the UART, Message, Ethernet, IEEE-1394, and Fibre Channel Chapter 10 channel data types.

Figure 9-9. Message Data Attributes Group (S)	Code Name
DATA LINK NAME - 9-134	(S-d\DLN)
TEST ITEM	(S-d\TA)
NUMBER OF STREAMS	(S-d\NS\N)
STREAM NAME	(S-d\SNA-i)
MESSAGE DATA TYPE	(S-d\MDT-i)
MESSAGE DATA LAYOUT	(S-d\MDL-i)
MESSAGE ELEMENT SIZE	(S-d\MES-i)
MESSAGE ID LOCATION	(S-d\MIDL-i)
MESSAGE LENGTH	(S-d\MLEN-i)
MESSAGE DELIMITER	(S-d\MDEL-i)
MESSAGE DELIMITER LENGTH	(S-d\MDLEN-i)
FIELD DELIMITER	(S-d\FDEL-i)
DATA ORIENTATION	(S-d\DO-i)
9-136 ***Message Content Definition**	
NUMBER OF MESSAGES	(S-d\NMS\N-i)
MESSAGE ID	(S-d\MID-i-n)
MESSAGE DESCRIPTION	(S-d\MNA-i-n)
NUMBER OF FIELDS	(S-d\NFLDS\N-i-n)
FIELD NUMBER	(S-d\FNUM-i-n-m)
FIELD START	(S-d\FPOS-i-n-m)
FIELD LENGTH	(S-d\FLEN-i-n-m)
9-136 ***Measurement Description Set**	
NUMBER OF MEASURANDS	(S-d\MN\N-i-n)
MEASUREMENT NAME	(S-d\MN-i-n-p)
PARITY	(S-d\MN1-i-n-p)
PARITY TRANSFER ORDER	(S-d\MN2-i-n-p)
DATA TYPE	(S-d\MBFM-i-n-p)
FLOATING POINT FORMAT	(S-d\MFPF-i-n-p)
DATA ORIENTATION	(S-d\MDO-i-n-p)
9-138 ***Measurement Location**	
NUMBER OF MEASUREMENT LOCATIONS	(S-d\NML\N-i-n-p)
MESSAGE FIELD NUMBER	(S-d\MFN-i-n-p-e)
BIT MASK	(S-d\MBM-i-n-p-e)
TRANSFER ORDER	(S-d\MTO-i-n-p-e)
FRAGMENT POSITION	(S-d\MFP-i-n-p-e)
9-139 ***Comments**	
COMMENTS	(S-d\COM)

*Heading Only - No Data Entry

Table 9-9. Message Data Attributes Group (S)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
DATA LINK NAME	S-d\DLN	Allowed when: R\CDT is either "UARTIN" or "MSGIN" or "ETHIN" or "FBCHIN"	Identify the data link name consistent with the Recorder-Reproducer group.
		Required when: Allowed	
		Links from: R-x\CDLN, R-x\EV\DLN-n	
		Range: 32 characters	
TEST ITEM	S-d\TA	Allowed when: S\DLN is specified	Test item description in terms of name, model, platform, or identification code that contains the data acquisition system.
		Range: 16 characters	
NUMBER OF STREAMS	S-d\NS\N	Allowed when: S\DLN is specified	Specify the number of message data streams included within this data link.
		Required when: Allowed	
		Range: 2 characters	
STREAM NAME	S-d\SNA-i	Allowed when: S\DLN is specified	Specify the message data stream name (subchannel name or same as data link name if no subchannel).
		Required when: Allowed	
		Range: 32 characters	
MESSAGE DATA TYPE	S-d\MDT-i	Allowed when: S\DLN is specified	Data type - "ASCII" or "BINARY".
		Range: Enumeration	
		Enumeration: ASCII; Description:	
		Enumeration: BINARY; Description:	
		Default: ASCII	
MESSAGE DATA LAYOUT	S-d\MDL-i	Allowed when: S\DLN is specified	Specify message data layout.
		Required when: Allowed	
		Range: Enumeration	
		Enumeration: DELIMITED; Description: Data layout [ASCII data type only]	
		Enumeration: FIXED; Description: ASCII or binary data types.	

Table 9-9. Message Data Attributes Group (S)

Parameter	Code Name	Usage Attributes		Definition
MESSAGE ELEMENT SIZE	S-d\MES-i	Allowed when: S\DLN is specified		Element size in number of bits.
		Required when: Allowed		
		Range: 2 characters		
		Default: 8		
MESSAGE ID LOCATION	S-d\MIDL-i	Allowed when: S\DLN is specified		Message ID field number.
		Required when: Allowed		
		Range: 4 characters		
MESSAGE LENGTH	S-d\MLEN-i	Allowed when: S-d\MDL-I is “FIXED”		Message length in number of message elements (fixed data layout only).
		Required when: Allowed		
		Range: 8 characters		
MESSAGE DELIMITER	S-d\MDEL-i	Allowed when: S-d\MDL-I is “DELIMITED”		Message delimiter - “CRLF” or “CR” or “LF” or hex value (delimited layout only).
		Required when: Allowed		
		Range: Hex or Enums		
MESSAGE DELIMITER LENGTH	S-d\MDLEN-i	Allowed when: S-d\MDL-I is “DELIMITED”		Message delimiter length in number of message elements (delimited layout only).
		Required when: Allowed		
		Range: 2 characters		
FIELD DELIMITER	S-d\FDEL-i	Allowed when: S-d\MDL-I is “DELIMITED”		Field delimiter - “,” or “|”, or “blank” or “tab”, or hex value (delimited layout only).
		Required when: Allowed		
		Range: Hex or Enums		
NOTE: A field is a set of elements determined by the number of elements or elements between field delimiters. A message consists of one or more fields, which can be fixed or variable length.				
DATA ORIENTATION	S-d\DO-i	Allowed when: S-d\MDT-I = “BINARY”.		Data orientation. Binary data type only.
		Range: Enumeration		
		Enumeration	Description	
		L	Little endian	
		B	Big endian	
		Default: Big Endian		

Table 9-9. Message Data Attributes Group (S)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Message Content Definition			
NUMBER OF MESSAGES	S-d\NMS\N-i	Allowed when: S\DLN is specified Required when: Allowed Range: 8 characters	The number of messages to be defined.
MESSAGE ID	S-d\MID-i-n	Allowed when: S-d\MIDL-I is not “0” Required when: Allowed Range: ASCII or Hex	Message ID value. ASCII value in quotes or hex value.
MESSAGE DESCRIPTION	S-d\MNA-i-n	Allowed when: S-d\MIDL-I is not “0” Range: 64 characters	Message description.
NUMBER OF FIELDS	S-d\NFLDS\N-i-n	Allowed when: S-d\MIDL-I is not “0” Required when: Allowed Range: 4 characters	Number of fields in the message.
FIELD NUMBER	S-d\FNUM-i-n-m	Allowed when: S-d\MIDL-I is not “0” Required when: Allowed Range: 4 characters	Specify the field number.
FIELD START	S-d\FPOS-i-n-m	Allowed when: S-d\MDL-I is “FIXED” Required when: Allowed Range: 5 characters	Enter the element position of the field (only for fixed column message data layout).
FIELD LENGTH	S-d\FLEN-i-n-m	Allowed when: S-d\MDL-I is “FIXED” Required when: Allowed Range: 5 characters	Enter the field length (only for fixed message data layout). If message data type is ASCII, ASCII string in field is converted to specified data type, i.e., float. If message data type is binary, field is cast as specified data type, i.e., unsigned, signed, float, ASCII, etc.
Measurement Description Set			
NUMBER OF MEASURANDS	S-d\MN\N-i-n	Allowed when: S\DLN is specified Range: 4 characters	Specify the number of measurands.
MEASUREMENT NAME	S-d\MN-i-n-p	Allowed when: S\MN\N > 0 Links to: C-d\DCN Range: 32 characters	Measurand name.

Table 9-9. Message Data Attributes Group (S)

Parameter	Code Name	Usage Attributes		Definition
PARITY	S-d\MN1-i-n-p	Allowed when: S\MN\N > 0		Normal word parity.
		Range: Enumeration		
		Enumeration	Description	
		EV	Even	
		OD	Odd	
		NO	None	
		Default: NO		
PARITY TRANSFER ORDER	S-d\MN2-i-n-p	Allowed when: S\MN\N > 0		Parity bit location.
		Range: Enumeration		
		Enumeration	Description	
		L	Leads word	
		T	Trails word	
DATA TYPE	S-d\MBFM-i-n-p	Allowed when: S\MN\N > 0		Data type. If message data type is binary then only ASCII, signed, unsigned, and float are valid.
		Range: Enumeration		
		Enumeration	Description	
		ASCII	ASCII characters	
		FLOAT	Binary floating point data	
		SIGNED	Binary signed integer data	
		UNSIGNED	Binary unsigned integer data	
		HEX	ASCII characters 0-9, A-F	
		OCTAL	ASCII characters 0-7	
		BINARY	ASCII characters 0 and 1	
NOTE: For binary messages, the data type describes the format of the raw input data as it appears in the stream. If FLOAT is specified in a binary message, the floating point format attribute describes the specific floating point data type. For ASCII messages, FLOAT, SIGNED, and UNSIGNED define how to interpret the ASCII data for conversion to an output data type for numeric processing.				
FLOATING POINT FORMAT	S-d\MFPF-i-n-p	Allowed when: S\MN\N > 0		If data type is "float", specify which floating point format will be used. Only for binary message data type. See Appendix 9-D for more information.
		Range: Enumeration		
		Enumeration	Description	
		IEEE_32	IEEE 754 single precision	

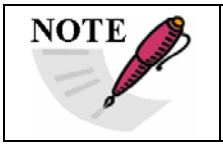
Table 9-9. Message Data Attributes Group (S)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		IEEE_64	IEEE 754 double precision	
		1750A_32	MIL-STD 1750A single precision	
		1750A_48	MIL-STD 1750A double precision	
		DEC_32	DEC single precision	
		DEC_64	DEC double precision	
		DEC_64G	DEC "G" double precision	
		IBM_32	IBM single precision	
		IBM_64	IBM double precision	
		TI_32	TI single precision	
		TI_40	TI extended precision	
DATA ORIENTATION	S-d\MDO-i-n-p	Allowed when: S\MN\N > 0		Data orientation. Binary data type only.
		Range: Enumeration		
		Enumeration	Description	
		L	Little endian	
		B	Big endian	
		Default: Big Endian		
Measurement Location				
NUMBER OF MEASUREMENT LOCATIONS	S-d\NML\N-i-n-p	Allowed when: S\MN\N > 0		If this measurement is contained in one field, enter "1". If this measurement is fragmented, enter the number of fragments.
		Range: 2 characters		
MESSAGE FIELD NUMBER	S-d\MFN-i-n-p-e	Allowed when: S\NML\N > 0		Enter the field number within a message that contains the measurement or the fragmented measurand.
		Range: 4 characters		
BIT MASK	S-d\MBM-i-n-p-e	Allowed when: S\NML\N > 0		Binary string of 1s and 0s to identify the bit locations that are assigned to this measurement in the field identified above. If the entire field is used for this measurement, enter "FW". Left-most bit corresponds to the msb.
		Range: Binary or FW		

Table 9-9. Message Data Attributes Group (S)

Parameter	Code Name	Usage Attributes		Definition
TRANSFER ORDER	S-d\MTO-i-n-p-e	Allowed when: S\NML\N > 0		Specify transfer order bit as most significant or least significant.
		Range: Enumeration		
		Enumeration	Description	
		MSB	msb	
		LSB	lsb	
FRAGMENT POSITION	S-d\MFP-i-n-p-e	Allowed when: S\NML\N > 0		A number from 1 to N specifying the position of this fragment within the reconstructed binary field. 1 corresponds to the most significant fragment. Each fragment position from 1 to N must be specified only once.
		Range: 1-8		
NOTE: Repeat the above to describe each fragment of a fragmented field. The transfer order indicates whether to transpose the order of the bit sequence or not (lsb indicates to transpose the bit sequence).				
Comments				
COMMENTS	S-d\COM	Allowed when: S\DLN is specified		Provide the additional information requested or any other information desired.
		Range: 3200 characters		

9.5.7 Data Conversion Attributes (C)

The Data Conversion Attributes group includes a definition of the method by which the raw telemetry data is to be converted to meaningful information. The sensor calibration is contained in the group for each type of sensor that uses a standard calibration curve or for each sensor or parameter that has a unique calibration requirement. The calibration information can be entered in several different formats. Provision is made to permit a test organization to convert data set entries to coefficients of an appropriate curve fit and record the derived coefficients. Figure 9-10 shows the structure of the data conversion attributes. Table 9-10 contains the detailed information required.



For reference purposes, the following telemetry unit definitions apply:
- PCM - natural binary range as indicated by binary format entry
- FM (Analog) - lower band edge (−100) to upper band edge (+100).

Figure 9-10. Data Conversion Attributes Group (C)				Code Name
MEASUREMENT NAME - 9-143				(C-d\DCN)
9-143	***Transducer Information**			
		TYPE		(C-d\TRD1)
		MODEL NUMBER		(C-d\TRD2)
		SERIAL NUMBER		(C-d\TRD3)
		SECURITY CLASSIFICATION		(C-d\TRD4)
		ORIGINATION DATE		(C-d\TRD5)
		REVISION NUMBER		(C-d\TRD6)
		ORIENTATION		(C-d\TRD7)
9-144		***Point of Contact**		
			NAME	(C-d\POC1)
			AGENCY	(C-d\POC2)
			ADDRESS	(C-d\POC3)
			TELEPHONE	(C-d\POC4)
9-144	***Measurand**			
		DESCRIPTION		(C-d\MN1)
		MEASUREMENT ALIAS		(C-d\MNA)
		EXCITATION VOLTAGE		(C-d\MN2)
		ENGINEERING UNITS		(C-d\MN3)
		LINK TYPE		(C-d\MN4)
9-144	***Telemetry Value Definition**			
		BINARY FORMAT		(C-d\BFM)
		***Floating Point**		
			FLOATING POINT FORMAT	(C-d\FPF)
		***Bit Weight**		
			NUMBER OF BITS	(C-d\BWT\N)
			BIT NUMBER	(C-d\BWTB-n)
			BIT WEIGHT VALUE	(C-d\BWTV-n)
9-146	***In-Flight Calibration**			

			NUMBER OF POINTS	(C-d\MC\N)
			STIMULUS	(C-d\MC1-n)
			TELEMETRY VALUE	(C-d\MC2-n)
			DATA VALUE	(C-d\MC3-n)
9-147		***Ambient Value**		
			NUMBER OF AMBIENT CONDITIONS	(C-d\MA\N)
			STIMULUS	(C-d\MA1-n)
			TELEMETRY VALUE	(C-d\MA2-n)
			DATA VALUE	(C-d\MA3-n)
9-147		***Other Information**		
			HIGH MEASUREMENT VALUE	(C-d\MOT1)
			LOW MEASUREMENT VALUE	(C-d\MOT2)
			HIGH ALERT LIMIT VALUE	(C-d\MOT3)
			LOW ALERT LIMIT VALUE	(C-d\MOT4)
			HIGH WARNING LIMIT VALUE	(C-d\MOT5)
			LOW WARNING LIMIT VALUE	(C-d\MOT6)
			INITIAL VALUE	(C-d\MOT7)
			SAMPLE RATE	(C-d\SR)
9-148		***Data Conversion**		
			DATE AND TIME RELEASED	(C-d\CRT)
			CONVERSION TYPE	(C-d\DCT)
9-149			***Engineering Units Conversion**	
9-149			***Pair Sets**	
				NUMBER OF SETS (C-d\PS\N)
				APPLICATION (C-d\PS1)
				ORDER OF FIT (C-d\PS2)
				TELEMETRY VALUE (C-d\PS3-n)
				ENGINEERING UNITS VALUE (C-d\PS4-n)
9-149	OR		***Coefficients**	
				ORDER OF CURVE FIT (C-d\CO\N)
9-150				DERIVED FROM PAIR SET (C-d\CO1)
				COEFFICIENT (0) (C-d\CO)
				N-TH COEFFICIENT (C-d\CO-n)
		OR	***Coefficients (Negative Powers of X)**	
				ORDER (C-d\NPC\N)
				DERIVED FROM PAIR SET (C-d\NPC1)
				COEFFICIENT (0) (C-d\NPC)
				N-TH COEFFICIENT (C-d\NPC-n)
9-151		OR	***Other**	
				DEFINITION OF OTHER DATA CONVERSION (C-d\OTH)
9-151		OR	***Derived Parameter**	
				ALGORITHM TYPE (C-d\DPAT)
				ALGORITHM (C-d\DPA)
				TRIGGER MEASURAND (C-d\DPTM)

			NUMBER OF OCCURRENCES	(C-d\DPNO)
			NUMBER OF INPUT MEASURANDS	(C-d\DP\N)
			MEASURAND #N	(C-d\DP-n)
			NUMBER OF INPUT CONSTANTS	(C-d\DPC\N)
			CONSTANT #N	(C-d\DPC-n)
9-152		OR	***Discrete**	
			NUMBER OF EVENTS	(C-d\DIC\N)
			NUMBER OF INDICATORS	(C-d\DICI\N)
			CONVERSION DATA	(C-d\DICC-n)
			PARAMETER EVENT DEFINITION	(C-d\DICP-n)
9-152		OR	*** PCM Time**	
			PCM TIME WORD FORMAT	(C-d\PTM)
9-153		OR	*** 1553 Time**	
			1553 TIME WORD FORMAT	(C-d\BTM)
9-153		OR	***Digital Voice**	
			ENCODING METHOD	(C-d\VOI\E)
			DESCRIPTION	(C-d\VOI\D)
9-153		OR	***Digital Video**	
			ENCODING METHOD	(C-d\VID\E)
			DESCRIPTION	(C-d\VID\D)
	***Comments**			
9-154	COMMENTS			(C-d\COM)
*Heading Only - No Data Entry				

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
MEASUREMENT NAME	C-d\DCN	Allowed when: Always	Give the measurement name.
		Links from: R-x\AMN-n-m , R-x\AMN-n-m M-x\SI\MN-n , M-x\BB\MN , D-x\MN-y-n , B-x\UMN1-i , B-x\UMN2-i , B-x\UMN3-i , B-x\MN-i-n-p , S-d\MN-i-n-p, R-x\DMN-n-m	
		Range: 32 characters	
Transducer Information			
TYPE	C-d\TRD1	Allowed when: C-d\DCN is specified	Type of sensor, if appropriate.
		Range: 32 characters	
MODEL NUMBER	C-d\TRD2	Allowed when: C-d\DCN is specified	If appropriate.
		Range: 32 characters	
SERIAL NUMBER	C-d\TRD3	Allowed when: C-d\DCN is specified	If applicable.
		Range: 32 characters	
SECURITY CLASSIFICATION	C-d\TRD4	Allowed when: C-d\DCN is specified	Enter the security classification of this measurand. Append the following: If received telemetry signal (Counts) is classified, add "R". If expressed in engineering units, the measurand value is classified, add "E". If both are classified, add "B".
		Range: Enumeration	
		Enumeration: U — Unclassified	
		Enumeration: C — Confidential	
		Enumeration: S — Secret	
		Enumeration: T — Top secret	
		Enumeration: O — Other	
ORIGINATION DATE	C-d\TRD5	Allowed when: C-d\DCN is specified	Date of origination of this data file. "DD" (Day). "MM" (Month). "YYYY" (Year).
		Range: MM-DD-YYYY	
REVISION NUMBER	C-d\TRD6	Allowed when: C-d\DCN is specified	Specify the revision number of the data provided.
		Range: 4 characters	
ORIENTATION	C-d\TRD7	Allowed when: C-d\DCN is specified	Describe the physical orientation of the sensor.
		Range: 32 characters	

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Point of Contact			
NAME	C-d\POC1	Allowed when: C-d\DCN is specified Range: 24 characters	Point of contact with the organization that provided the calibration data.
AGENCY	C-d\POC2	Allowed when: C-d\DCN is specified Range: 48 characters	Point of contact with the organization that provided the calibration data.
ADDRESS	C-d\POC3	Allowed when: C-d\DCN is specified Range: 48 characters	Point of contact with the organization that provided the calibration data.
TELEPHONE	C-d\POC4	Allowed when: C-d\DCN is specified Range: 20 characters	Point of contact with the organization that provided the calibration data.
Measurand			
DESCRIPTION	C-d\MN1	Allowed when: C-d\DCN is specified Range: 64 characters	Describe the parameter being measured.
MEASUREMENT ALIAS	C-d\MNA	Allowed when: C-d\DCN is specified Range: 32 characters	Alternate measurand name.
EXCITATION VOLTAGE	C-d\MN2	Allowed when: C-d\DCN is specified Range: 10 characters	Sensor reference voltage, in volts.
ENGINEERING UNITS	C-d\MN3	Allowed when: C-d\DCN is specified Range: 16 characters	Define the engineering units applicable to the output data.
LINK TYPE	C-d\MN4	Allowed when: C-d\DCN is specified Range: Enumeration Enumeration: ANA — FM (analog); PCM; OTH — Other Default: PCM	Define the source data link type.
Telemetry Value Definition			
BINARY FORMAT	C-d\BFM	Allowed when: C-d\DCN is specified Required when: Allowed Range: Enumeration	Format of the binary information.

Table 9-10. Data Conversion Attributes Group (C)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		Enumeration	Description	
		INT	Integer	
		UNS	Unsigned Binary	
		SIG	Sign And Magnitude Binary [+=0]	
		SIM	Sign And Magnitude Binary [+=1]	
		ONE	One's Complement	
		TWO	Two's Complement	
		OFF	Offset Binary	
		FPT	Floating Point	
		BCD	Binary Coded Decimal	
		BWT	Bit Weight	
		OTH	Other, define in comments	
Floating Point				
FLOATING POINT FORMAT	C-d\FPF	Allowed when: C\BFM is "FPT"		If binary format is "FPT", specify which floating point format will be used. Other formats are not excluded. See Appendix 9-D for more information.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		IEEE_32	IEEE 754 single precision	
		IEEE_64	IEEE 754 double precision	
		1750A_32	MIL-STD-1750A single precision	
		1750A_48	MIL-STD-1750A double precision	
		DEC_32	DEC single precision	
		DEC_64	DEC double precision	
		DEC_64G	DEC "G" double precision	
		IBM_32	IBM single precision	

Table 9-10. Data Conversion Attributes Group (C)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		IBM_64	IBM double precision	
		TI_32	TI single precision	
		TI_40	TI extended precision	
Bit Weight				
NUMBER OF BITS	C-d\BWT\N	Allowed when: C\BFM is "BWT"		Specify the number of bits that will have a weighted value assigned.
		Required when: Allowed		
		Range 1-64		
BIT NUMBER	C-d\BWTB-n	Allowed when: C\BFM is "BWT"		Bit number, as defined in Chapter 4, Subparagraph 4.3.1.c (msb is bit 1).
		Required when: Allowed		
		Range 1-64		
BIT WEIGHT VALUE	C-d\BWTV-n	Allowed when: C\BFM is "BWT"		Numerical value indicated by each bit. To specify the sign bit, enter "S".
		Required when: Allowed		
		Range: Floating Point or "S"		
In-Flight Calibration				
NUMBER OF POINTS	C-d\MC\N	Allowed when: C-d\DCN is specified and defining "Inflight Calibration"		Is in-flight calibration required? "N" for no or the number of calibration points.
		Range: 0-999 or "N"		
		Default: N		
STIMULUS	C-d\MC1-n	Allowed when: C-d\MC\N is not N		Provide the stimulus for this calibration point.
		Range: 32 characters		
TELEMETRY VALUE	C-d\MC2-n	Allowed when: C-d\MC\N is not N		Telemetry units value.
		Required when: Allowed		
		Range: Integer		
DATA VALUE	C-d\MC3-n	Allowed when: C-d\MC\N is not N		Engineering units value.
		Required when: Allowed		
		Range: Floating Point		
NOTE: The above set of three entries must be repeated for each in-flight calibration point.				

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Ambient Value			
NUMBER OF AMBIENT CONDITIONS	C-d\MA\N	Allowed when: C-d\DCN is specified and defining "Ambient Values" Range: 0-999 Default: 0	Number of static or simulated conditions.
STIMULUS	C-d\MA1-n	Allowed when: C-d\MA\N is not 0 Range: 32 characters	Description of the static environment in which a non-test stimulus or simulator is the data source.
TELEMETRY VALUE	C-d\MA2-n	Allowed when: C-d\MA\N is not 0 Required when: Allowed Range: Integer	Telemetry units value for the static stimulus.
DATA VALUE	C-d\MA3-n	Allowed when: C-d\MA\N is not 0 Required when: Allowed Range: Floating Point	Engineering units value for the static or simulated condition.
Other Information			
HIGH MEASUREMENT VALUE	C-d\MOT1	Allowed when: C-d\DCN is specified Range: Floating Point	Highest engineering unit value defined in the calibration data.
LOW MEASUREMENT VALUE	C-d\MOT2	Allowed when: C-d\DCN is specified Range: Floating Point	Lowest engineering unit value defined in the calibration data.
HIGH ALERT LIMIT VALUE	C-d\MOT3	Allowed when: C-d\DCN is specified Range: Floating Point	Highest engineering unit value expected or safe operating value of the parameter ("red").
LOW ALERT LIMIT VALUE	C-d\MOT4	Allowed when: C-d\DCN is specified Range: Floating Point	Lowest engineering unit value expected or safe operating value of the parameter ("red").
HIGH WARNING LIMIT VALUE	C-d\MOT5	Allowed when: C-d\DCN is specified Range: Floating Point	Highest engineering unit value expected or safe operating value of the parameter ("yellow").
LOW WARNING LIMIT VALUE	C-d\MOT6	Allowed when: C-d\DCN is specified Range: Floating Point	Lowest engineering unit value expected or safe operating value of the parameter ("yellow").

Table 9-10. Data Conversion Attributes Group (C)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
INITIAL VALUE	C-d\MOT7	Allowed when: C-d\DCN is specified		For Chapter 10 recorders, this is the initial engineering unit value used for mode 7 measurement change event conditions.
		Range: Floating Point		
SAMPLE RATE	C-d\SR	Allowed when: C-d\DCN is specified		Enter the sample rate in terms of samples per second.
		Range: 6 characters		
Data Conversion				
DATE AND TIME RELEASED	C-d\CRT	Allowed when: C-d\DCN is specified		Date and time calibration was released using the format defined in Subsection 9.5.1.
		Range: MM-DD-YYYY-HH-MI-SS		
CONVERSION TYPE	C-d\DCT	Allowed when: C-d\DCN is specified		Define the characteristics of the data conversion.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		NON	None	
		Engineering Units:		
		PRS	Pair Sets	
		COE	Coefficients	
		NPC	Coefficients [Negative Powers Of X]	
		DER	Derived	
		DIS	Discrete	
		PTM	PCM Time	
		BTM	1553 Time	
		VOI	Digital Voice	
		VID	Digital Video	
		OTH	Other	
		SP	Special Processing, enter in comments	

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
Engineering Units Conversion			
Pair Sets			
NUMBER OF SETS	C-d\PS\N	Allowed when: C\DCT is "PRS" or C-d\CO1 is "Y" Required when: Allowed Range: 2-32	Specify the number of pair sets provided, n.
APPLICATION	C-d\PS1	Allowed when: C\DCT is "PRS" Range: Enumeration Enumeration: Description Y: Yes N: No Default: N	Are the pair sets to be used to define a polynomial curve fit? If the answer is no, then the pair sets are to be used as a "table lookup" with linear interpolation between the defined points.
ORDER OF FIT	C-d\PS2	Allowed when: C\PS1 is "Y" Required when: Allowed Range: 1-100 or "BF"	Specify the order of the curve fit to be performed, m. At least 2 pair sets must be provided, and a maximum of 32 pair sets may be included. Twelve or more pair sets are recommended for a fifth order fit. Use "BF" for Best Fit.
TELEMETRY VALUE	C-d\PS3-n	Allowed when: C\DCT is "PRS" or C-d\CO1 is "Y" Required when: Allowed Range: Floating Point	Telemetry units value.
ENGINEERING UNITS VALUE	C-d\PS4-n	Allowed when: C\DCT is "PRS" or C-d\CO1 is "Y" Required when: Allowed Range: Floating Point	Engineering units value.
NOTE: Repeat the above for the n pair sets.			
Coefficients			
ORDER OF CURVE FIT	C-d\CO\N	Allowed when: C\DCT is "COE" Required when: Allowed Range: 1-100	Specify the order of the polynomial curve fit, n.

Table 9-10. Data Conversion Attributes Group (C)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
DERIVED FROM PAIR SET	C-d\CO1	Allowed when: C\DCT is "COE"		Were the coefficients derived from the pair set calibration data provided ("Y" or "N")? If yes, provide a point of contact in the comments.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
COEFFICIENT (0)	C-d\CO	Allowed when: C\DCT is "COE"		Value of the zero-order term (offset).
		Required when: Allowed		
		Range: Floating Point		
N-TH COEFFICIENT	C-d\CO-n	Allowed when: C\DCT is "COE"		Value of the coefficient of the n^{th} power of x (first order coefficient is the equivalent of bit weight).
		Required when: Allowed		
		Range: Floating Point		
NOTE: Repeat until all n+1 coefficients are defined.				
Coefficients (Negative Powers of X)				
ORDER	C-d\NPC\N	Allowed when: C\DCT is "NPC"		Specify the order of negative power coefficients, n.
		Required when: Allowed		
		Range: 1-100		
DERIVED FROM PAIR SET	C-d\NPC1	Allowed when: C\DCT is "NPC"		Were the coefficients derived from the pair set calibration data provided ("Y" or "N")? If yes, provide a point of contact in the comments.
		Range: Enumeration		
		Enumeration	Description	
		Y	Yes	
		N	No	
		Default: N		
COEFFICIENT (0)	C-d\NPC	Allowed when: C\DCT is "NPC"		Value of the zero-order term (offset).
		Required when: Allowed		
		Range: Floating Point		
N-TH COEFFICIENT	C-d\NPC-n	Allowed when: C\DCT is "NPC"		Value of the coefficient of the negative n^{th} power of x.
		Required when: Allowed		
		Range: Floating Point		

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
NOTE: Repeat until all n+1 coefficients are defined. This section describes the conversion equation $y=c0 + c1*(1/x) + c2*(1/x^2) + \ldots + cn*(1/x^n)$, where c0, c1, c2,…,cn are the coefficients, x is the telemetry value, and y is the resulting EU value.			
Other			
DEFINITION OF OTHER DATA CONVERSION	C-d\OTH	Allowed when: C\DCT is "OTH" or "SP" Required when: Allowed Range: 1000 characters	Define other data conversion technique or special processing requirement.
Derived Parameter			
ALGORITHM TYPE	C-d\DPAT	Allowed when: C\DCT is "DER" Required when: Allowed Range: Enumeration Enumeration: N — Name of algorithm; A — Algorithm	Specify whether the algorithm will be given (in C-d\DPA) as: "N" (Name of algorithm). "A" (Algorithm). See Appendix 9-E for additional details.
ALGORITHM	C-d\DPA	Allowed when: C\DCT is "DER" Required when: Allowed Range: 1024 characters	Define the algorithm to be used in deriving the parameter. See Appendix 9-E for additional details.
TRIGGER MEASURAND	C-d\DPTM	Allowed when: C\DCT is "DER" Required when: Allowed Range: 32 characters Links to: C-d\DCN	Specify the name of the input measurand that triggers the calculation of the derived parameter.
NUMBER OF OCCURRENCES	C-d\DPNO	Allowed when: C\DCT is "DER" Range: 2 characters	Specify how many times the trigger measurand must occur before the calculation is done. Default is 1.
NUMBER OF INPUT MEASURANDS	C-d\DP\N	Allowed when: C\DPAT is "N" Required when: Allowed Range: 1-100	Specify the number of input measurands used to derive this parameter.
MEASURAND #N	C-d\DP-n	Allowed when: C\DPAT is "N" Required when: Allowed Range: 32 characters Links to: C-d\DCN	Specify the name of the n^{th} input measurand.

Table 9-10. Data Conversion Attributes Group (C)

Parameter	Code Name	Usage Attributes	Definition
NOTE: Continue until all n measurands are defined.			
NUMBER OF INPUT CONSTANTS	C-d\DPC\N	Allowed when: C\DPAT is "N" Required when: Allowed Range: 1-100	Specify the number of input constants used to derive this parameter.
CONSTANT #N	C-d\DPC-n	Allowed when: C\DPAT is "N" Required when: Allowed Range: Floating Point	Specify the value for the n^{th} constant.
NOTE: Continue until all n constants are defined.			
Discrete			
NUMBER OF EVENTS	C-d\DIC\N	Allowed when: C\DCT is "DIS" Required when: Allowed Range: 1-100	How many events are associated with this discrete field, n?
NUMBER OF INDICATORS	C-d\DICI\N	Allowed when: C\DCT is "DIS" Required when: Allowed Range: 1-100	Number of indicators: For a PCM system, provide the number of bits used for this discrete set. For an analog channel, provide the number of levels used to define this discrete set.
CONVERSION DATA	C-d\DICC-n	Allowed when: C\DCT is "DIS" Required when: Allowed Range: Floating Point	Telemetry value, counts for PCM, percent of full scale for analog.
PARAMETER EVENT DEFINITION	C-d\DICP-n	Allowed when: C\DCT is "DIS" Required when: Allowed Range: 240 characters	Define the event for the bit or bit field in a word that corresponds to a discrete event or the percent full scale value such as switch on or off.
NOTE: Continue to define the events for each bit pattern or value of the discrete measurand.			
PCM Time			
PCM TIME WORD FORMAT	C-d\PTM	Allowed when: C\DCT is "PTM" Required when: Allowed Range: Enumeration Enumeration: H — Description: High-order time	Specify the PCM time word format used, as defined in Chapter 4 (Section 4.7).

Table 9-10. Data Conversion Attributes Group (C)				
Parameter	**Code Name**	**Usage Attributes**		**Definition**
		L	Low-order time	
		M	Microsecond time	
1553 Time				
1553 TIME WORD FORMAT	C-d\BTM	Allowed when: C\DCT is "BTM"		Specify the 1553 time word format used, as defined in Chapter 4 (Section 4.7) and Chapter 8 (Section 8.3).
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		H	High-order time	
		L	Low-order time	
		M	Microsecond time	
		R	Response time	
Digital Voice				
ENCODING METHOD	C-d\VOI\E	Allowed when: C\DCT is "VOI"		Specify the voice encoding method used.
		Required when: Allowed		
		Range: Enumeration		
		Enumeration	Description	
		CVSD	Continuously Variable Slope Delta modulation	
		OTHR	Other	
DESCRIPTION	C-d\VOI\D	Allowed when: C\DCT is "VOI"		Specify the decoding algorithm to be used.
		Required when: Allowed		
		Required condition: When C\VOI\E is "OTHR"		
		Range: 640 characters		
Digital Video				
ENCODING METHOD	C-d\VID\E	Allowed when: C\DCT is "VID"		Specify the video encoding method used.
		Required when: Allowed		
		Range: 64 characters		

Table 9-10. Data Conversion Attributes Group (C)			
Parameter	**Code Name**	**Usage Attributes**	**Definition**
DESCRIPTION	C-d\VID\D	Allowed when: C\DCT is "VID" Required when: Allowed Range: 640 characters	Specify the decoding algorithm to be used.
Comments			
COMMENTS	C-d\COM	Allowed when: C-d\DCN is specified Range: 3200 characters	Provide the additional information requested or any other information desired.

9.5.8 Airborne Hardware Attributes (H)

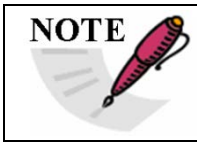
The Airborne Hardware Attributes group defines the specific configuration of airborne instrumentation hardware in use on the item under test. This group allows the same TMATS file to describe the airborne hardware as well as the telemetry attributes.

Specific information on the structure and definition of airborne hardware attributes is not included in this standard. There are far too many hardware systems to try to define them all in one group. The main purpose of identifying this group is to reserve the "H" designation for those instrumentation organizations that choose to use the TMATS standard in this way.

The only H group attributes defined in this standard are the following:

a. Test Item (code name H\TA) - specifies the item under test and ties the H group to the G group.

b. Airborne System Type (code name H\ST-n) - identifies the airborne systems being described in the current file and determines how the rest of the attributes in the H group will be interpreted.

	For anyone wishing to define an H group, it is strongly recommended that the conventions laid out in this standard be followed. The resultant document should maintain the look and feel of this standard for consistency.

9.5.9 Vendor-Specific Attributes (V)

The Vendor-Specific Attributes group provides information that is specific to a vendor. This group allows the TMATS file to include information about a particular vendor's equipment in use during a test. Detailed information about specific vendors' equipment is not included in this standard.

The only V-group attributes defined in this standard are the following.

a. Data Source ID (code name V-x\ID) - specifies the Data Source ID consistent with the General Information group and ties the V group to the G group.

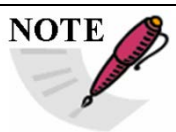
b. Vendor Name (code name V-x\VN) - a three-character acronym that identifies the specific vendor and determines how the rest of the attributes in the V group are interpreted.

All other code names for vendor-specific attributes will have the form:

V-x\acr\attribute-string

where: *acr* is the three-character acronym identifying a specific vendor.

attribute-string is any attribute that applies to this vendor.

	For anyone wishing to define a V group, it is strongly recommended that the conventions laid out in this standard be followed. The resultant document should maintain the look and feel of this standard for consistency.

9.5.10 TMATS eXtension Attributes (X)

The TMATS may be extended using X attributes. The format is described below:

X-x\ *ORGANIZATION* *ORIGCODE**EXTENSION_CODE*-i-j-m-n:Value;

Everything to the right of *ORGANIZATION* that matches an existing TMATS code is used to associate the extension with an existing object defined by the TMATS file.

The *ORIGCODE* contains the original group identifier (i.e., G,D,P, etc.) followed by a "\" and the original code that is to be extended (may include more "\" characters, but no "-") The *EXTENSION_CODE* identifies the specific extension and shall be unique (i.e., not overlapping any existing TMATS code name). The value of "-x" must match the first level index (P-x, etc.) value and the "-i-j" (the number of indexes defined by the original code) must match the same number of indexes in this extension code. The remaining "-m-n" values are unique to the extension.

For example, to extend a D section measurement:

D-1\MN-1-2:MEAS1;

To add a new extension code name for Sensor Gain, the following would define the extension:

X-1\MYORG\D\MN\SGAIN-1-2:10.75;

In this example, the -1 in the "X-1" and "-1-2" corresponds to the "-1" and "-1-2" in the original "D-1\MN-1-2" code word.

If the extension has more indexes than the original code, then the indexes of the original code link to the same number of left most indexes of the extension code.

The value of *ORGANIZATION* should be a unique name that identifies the organization that defined the extension.

The advantage of this extension is that software that is processing the TMATS will know that these codes refer to a particular item in the file (like a measurement or recorder). For software that recognizes the codes, it can process them. Otherwise they can be ignored.

If the file is being edited by a TMATS editor, it would notice the association and preserve it even if the editor doesn't know what the code means. Thus if the measurements were re-numbered and the index was 1-5 instead of 1-2, the extension code could be updated to preserve the link.

The values of "x" in "X-x" are not necessarily contiguous. The "x" values must match the index of the original code word therefore no new values may be added.

9.6 Data Display Standard: Data Display Markup Language

The standard format, DDML, has been developed to describe commonly used data displays. This DDML standard exists only as a collection of XSD files; it does not exist in the TMATS code name format described in Section 9.5. The DDML schema can be found here. Additionally, a graphical depiction of the schema in hypertext markup language (HTML) format

is available here. The HTML files are very large and will take time to download. The following paragraphs explain the purpose, objectives, and structure of DDML, and define the global elements in the schema.

9.6.1 Data Display Markup Language Purpose and Objectives

The purpose of DDML is to serve as the neutral interchange language between data display languages supported by different vendors. Built on XML, DDML has been designed with the following objectives in mind:

a. To include a standard terminology for describing data display components;

b. To be robust and highly expressive in order to accommodate any data display language;

c. To be highly unified and not a loose grouping of vendor formats.

9.6.2 Data Display Markup Language Layered Structure

The DDML is built off of a layered structure as shown on the left of Figure 9-11 below. This structure is parallel to a typical software layered architecture composed of graphics resources, visualization and user interfaces, information management, and persistence modules as shown on the right side of Figure 9-11.

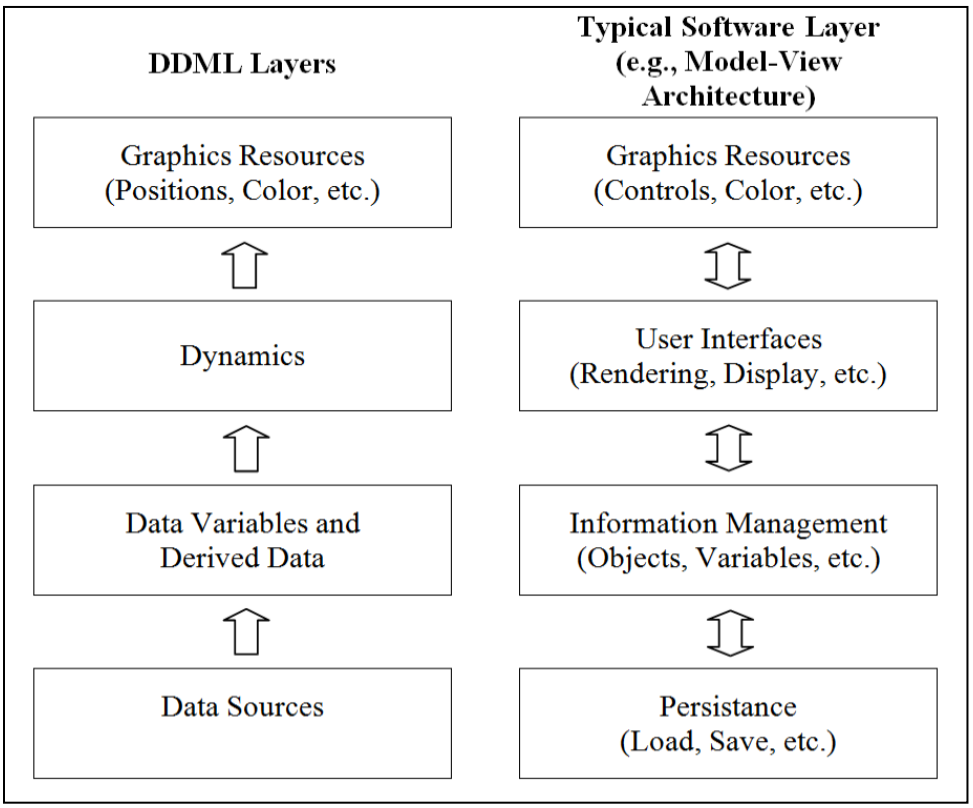


Figure 9-11. Layered Structure of DDML

Parallel to the typical software modules, DDML is also composed of layers (as depicted above in Figure 9-11) and as described below.

a. Graphics Resources. This layer is similar to “graphics resources” of a typical software tool. In DDML, this layer includes the visual components of a data display system such

as sliders, plots, and strip charts as well as low-level graphic elements such as lines, rectangles, etc. Basic graphical shapes are modeled using a World Wide Web Consortium (W3C) recommended format called Scalable Vector Graphics (SVG).

b. Dynamics. The dynamics layer handles the behavior of an object. It manages the rules and the variable instances attached to an object.

c. Data Variables. Data variables are the links between the objects and the data sources. Data variables can be atomic or derived. Derived variables may use other derived or atomic variables in a mathematical expression.

d. Data Sources. The last layer of the DDML architecture is the Data Sources layer. This layer handles various data sources such as text files, Open Database Connectivity (ODBC), network ports, and ports on data acquisition cards.

At each layer, the parameters used to describe each DDML element are divided into two groups: DDML sub-elements and custom parameters. The DDML sub-elements make up the most common and most necessary pieces of information needed to represent each element. They are stored as named sub-elements in DDML. Custom parameters are used to store any vendor-specific information that is not explicitly defined as a DDML sub-element. These parameters are stored as DDML "param" elements.

9.6.3 Data Display Markup Language Global Element Glossary

The DDML element names and descriptions can be seen in Table 9-11.

Table 9-11. Data Display Markup Language Global Element Glossary

Element Name	Description
mathml:apply	Defined in the mathml schema and used as a sub-element of variable in DDML, defines a variable as a function of other variables.
axis	A sub-element of a display object, represents an axis of any chart-type display object. It has a sub-element axisType that can be one of two values: VALUE or TIME. Other sub-elements allow the setting of min and max values, colors, grid line properties, etc.
barchart	A display object that shows one or more variables as vertical or horizontal bars whose lengths correspond to the values.
button	A display object that consists of an image or icon that, when clicked, can assign a value to a variable.
color	A commonly used sub-element of many DDML elements, it simply specifies the color of its parent object. All colors in DDML are stored as base-10 integers that are encoded as 0xRRGGBB.
comparisonOperator	Used in rules, defines the comparison between two values. Can be either GT (greater than), LT (less than), GTE (greater than or equal), LTE (less than or equal), EQ (equal), or NEQ (not equal).
custom_parameters	A sub-element of a display object, serves as the parent element of a group of param elements that specify all of the custom (vendor-specific) parameters for a particular display object.

Table 9-11. Data Display Markup Language Global Element Glossary	
Element Name	**Description**
data_source	A pool-level data source that is available for use by any of the variables in the variable pool.
data_source_pool	Contains data_source child elements representing all of the data sources used by the various objects in the DDML file. Information about all data sources (files, db connections, etc.) is kept in the data source pool.
ddml	Root element of a DDML file describing a collection of data displays.
dial	A display object that consists of a circular or arc value axis and some sort of marker or needle that points to the current value along this axis. Example: a gauge or a compass.
display_objects	A sub-element of a model, serves as a container for all of the display objects in that model.
dynamics	A set of variable uses and rules used to define the dynamic behavior of a display object. The dynamicType sub-element describes the dynamic behavior while the variable_use and rules child elements define how variable values affect that behavior. A dynamicType of "builtin" is used for display objects that have implicit dynamic behavior, such as charts and sliders. Other possible values of dynamicType include: visibility, text, subdrawing, scale, scaleY, scaleX, rotate, relativeMoveY, relativeMoveX, pathMove, lineWidth, lineStyle, foregroundColor, fillUp, fillRight, fillLeft, fillDown, fillEffect, curveType, blink, backgroundColor, arcDirection, absoluteMoveX, absoluteMoveY, fillColor, edgeColor.
else	Part of a rule, specifies what to do if the criteria specified in the if element are false. The else element can be the parent of one or more additional rules, or can just specify a value or variable reference.
frequencyplot	A display object that is a chart in the frequency domain.
frequencyresponse	A display object that is a graph consisting of two value axes (frequency and magnitude) plotted against a single frequency axis.
grid	A table. The grid element is used to group several display objects (including other grids) together in a tabular layout. Each display sub-object's location in the grid is specified with its gridRow and gridColumn elements.
hud	A display object that resembles a typical aircraft heads-up display that consists of three vertical axes (typically used for velocity, pitch, and altitude) and one horizontal axis (typically for heading). The center vertical axis rotates according to a fifth variable (typically roll). The variable_uses in the dynamics section are applied in this order: center vertical axis rotation (roll), center vertical axis (pitch), horizontal axis (heading), right vertical axis (altitude), left vertical axis (velocity).
if	Part of a rule, specifies a comparison between the current variable and some value.

Table 9-11. Data Display Markup Language Global Element Glossary	
Element Name	**Description**
map	An area of a model that displays longitude/latitude map info. The coordinates of all child objects of a map are in decimal latitude/longitude values. For distance attributes (e.g., a circle's radius), degrees latitude are used as the measurement unit.
model	A container for data displays. Typically interpreted as a single screen or "page" of display objects. The model object defines its own coordinate system with the minX, minY, maxX, maxY, xDirection, and yDirection sub-elements. All sub-objects of a model are specified in coordinates that conform to the system defined by the model.
object	A generic display object. An "object" can be any display object not specified in the DDML definition, or can be used as the top-level element in a group of sub-objects.
param	Used to specify any parameter of a DDML element that is not explicitly specified elsewhere in the schema. These are commonly referred to as "custom parameters" and are mostly used for vendor-specific information.
piechart	A circular display object that shows the values of multiple variables as a percentage slice of their sum.
project	A collection of models.
radialchart	A display object that represents variable values as distances outward from a central point. A radial chart consists of two axes: a linear value axis and a circular axis. The circular axis can be either a time axis or a value axis. The type of the circular axis is controlled by its axisType sub-element, which can have a value of either "TIME" or "VALUE". If the value is "VALUE", then a series of xyPair objects will specify how the variables are paired. In each of these xyPairs, the X-value corresponds to the value in the circular axis direction, and the Y-value corresponds to the value in the radial axis direction.
rule	Specifies a change in a property (e.g., color, visibility) when a variable reaches a certain value or range of values. The ranges of values and resulting property values are specified with if, then, and else child elements.
rules	The parent element of a group of rule elements
slider	A display object that consists of some kind of indicator or icon that slides along a single value axis. A slider can be vertical or horizontal. Example: A "gauge" in Range View or a "fader" in Data Views.
stripchart	A display object that is essentially a line graph that plots values vs. time along a scrolling "paper" grid. A stripchart can be vertical or horizontal, and can scroll in any of the four directions (up, down, left, right). This is controlled by the scrollDirection sub-element. The scrollDirection element refers to the direction that the paper or background scrolls. For example, in a DataViews horizontal strip chart, the paper scrolls to the left while new values are plotted at the right edge of the graph. Thus, the scrollDirection is "left".

Table 9-11. Data Display Markup Language Global Element Glossary

Element Name	Description
svg:svg	SVG is a W3C recommendation and is defined in its own schema. In DDML, the <svg> element is used as a sub-element of <object> to define a display object in terms of the basic shapes of which it is composed.
textual	A display object used for representing text and labels, including both static and dynamic text (such as annunciators). If the text is dynamic, the valuePosition sub-element specifies where the dynamic value is in relation to the static label. Use valuePosition="center" if there is no label. The valueFormat sub-element is a C printf-style format string that specifies the format of the dynamic value. For example valueFormat = "%4.2f" indicates that the value should be output as a floating-point value with a maximum width of 4 and with 2 decimal places.
then	Part of a rule, the then element specifies the value to set the attribute to if the criteria specified in the if element is true. The then element can specify either the desired value or a reference to a variable containing the desired value.
variable	A pool-level data variable that is available for use by any of the display objects in the DDML file.
variable_pool	Contains variable child elements representing all of the variables used by the various display objects in the DDML file.
variable_use	A child of the dynamics element, variable_use is used to specify which variable from the variable pool is used. The pool_ref attribute must refer to the ID attribute of a variable element from the variable_pool.
xychart	A display object that is a line or xy scatter plot of variables in the y axis vs. other variables in the x axis. The x,y variable pairs are specified with the xyPair sub-elements.
xyPair	A sub-element of certain display objects, it describes how a chart's variable_use items are paired. Each xVar and yVar sub-element must refer to the ID of a variable_use element in the display object's dynamics section.

9.7 Instrumentation Hardware Abstraction Language

The IHAL is a standard for describing and interacting with instrumentation hardware in a vendor-neutral way. The IHAL was reviewed and adopted into IRIG 106 to serve the purpose originally intended for the Airborne Hardware Attributes (H) group described in Subsection 9.5.8, which has never been implemented. The IHAL standard consists of both an XML-based language and an application programming interface (API) specification, each of which are explained in greater detail below.

The IHAL language standard exists only as an XML schema; it does not exist in the TMATS code name format described in Section 9.5. The IHAL XML language schema consists of a collection of XSD files that define the structure of valid IHAL documents. The schemas are

available here. Additionally, a graphical depiction of the schema in HTML format is available here. The HTML files are very large and will take time to download.

9.7.1 Usage of External Schemas in IHAL

The IHAL XML schema makes use of three external XML schemas for describing concepts outside the scope of IHAL, such as data formats and engineering units. These schemas are not included with the IHAL schema and must be retrieved from the organization that produces them. Table 9-12 lists these external schemas and the versions required for this release of IHAL.

Table 9-12. IHAL External Schemas

Standard	Version used by IHAL	Global Types/Sub-schemas used by IHAL	Organization's URL
Metadata Description Language (MDL)	0.8.12	DerivedUnitType MeasurementsType DataStreamsType	http://www.inetprogram.org
TMATS - XML Schema	106-17	TmatsPGroup.xsd TmatsRGroup.xsd	http://www.wsmr.army.mil/RCCsite/Documents/References/tmats
eXtensible Instrumentation Definition Markup Language (XidML)	3.0	Network-TransportType	http://www.xidml.org/

9.7.2 What is the Instrumentation Hardware Abstraction Language?

The central concept in IHAL is the configurable attributes (i.e., settings) that each device exposes to the user; however, IHAL is also capable of describing the environmental and physical attributes of each device, such as its size, shape, and operating conditions.

The IHAL describes instrumentation hardware at two levels.

a. The "pool" level describes hardware according to its capabilities and configurability. The information in the IHAL pool is similar to the information found in a device's marketing or engineering data sheet. A good way to think of the pool is to understand that each device in the pool can be uniquely identified by its model number.

b. The "use" level describes a specific configuration of instrumentation hardware. At the use level, devices from the pool are put into a specific use. That is, they are connected to other devices, and their configurable attributes are set to specific values. A good way to think of the use level is to understand that each device at this level can be uniquely identified by its serial number.

9.7.3 What is the IHAL API?

The IHAL vendor web services API enables IHAL to be used not only as a language for describing instrumentation hardware, but also as a command and query language for configuring instrumentation hardware. The API defines a set of functions that an instrumentation hardware vendor can implement to provide access to their configuration engine to external users and

applications. All inputs and outputs to the functions are properly formatted IHAL XML documents.

Implementing this API allows vendors to expose the functionality of their configuration engines in a vendor-neutral way, without disclosing the inner workings of their proprietary configuration logic. In this way, vendor-neutral, 3rd-party applications can be developed to configure the hardware of any vendor who implements the IHAL API. The developers of such 3rd- (or 1st-) party applications need not understand the inner workings of each vendor's configuration engine.

9.7.4 How Can IHAL Be Used?

The potential uses of IHAL fall into two major categories: 1) IHAL as a description language, and 2) IHAL as a command language.

9.7.4.1 IHAL as a Description Language

As a vendor-neutral, human-readable language for describing instrumentation hardware, IHAL provides a means for storing a permanent record of the devices used during a test and their settings during that test. This description will remain readable and relevant even if the hardware vendors radically change their file formats or cease to exist.

Additionally, providing such descriptions enables the development of vendor-neutral tools. The capabilities of these tools can range anywhere from simple visualization (e.g., instrumentation network and configuration visualization) to complex automated reasoning (e.g., automatically selecting and configuring devices from multiple vendors based on user-defined requirements).

9.7.4.2 IHAL as a Command Language

The IHAL constructs that describe the current configuration of a device can also be used to issue a command to the device to change its configuration. When combined with the API (described above), this feature of IHAL enables multi-vendor instrumentation configuration from a single user interface without requiring vendors to share knowledge about the internal workings of their configuration engines.

9.7.5 IHAL Glossary

Below is an alphabetical list of definitions of key elements in the IHAL XML language.

A

accelerometer: A specialization of the "transducer" element for describing accelerometers (pool-level).

analogSignalConditioningCard: A specialization of the "card" element for describing analog signal conditioning cards (pool-level).

analogSignalConditioningChannel: A specialization of the "customHardwareChannel" element for describing analog signal conditioning channels (pool-level).

analogSignalConditioningFunction: A specialization of the "customFunction" element for describing analog signal conditioning.

analogSignalFilterFunction: A specialization of the "customFunction" element for describing analog signal filtering (pool-level).

analogToDigitalConversionFunction: A specialization of the "customFunction" element for describing analog-to-digital conversion.

B

bridgeSensor: A specialization of the "transducer" element for describing bridge sensors (pool-level).

busMonitorCard: A specialization of the "card" element for describing bus monitor cards.

busMonitorChannel: A specialization of the "customHardwareChannel" element for describing bus monitor channels (pool-level).

busMonitorChannelUse: A specialization of the "channelUse" element for bus monitors. This element includes an additional construct for defining a dataStreamUse associated with the channel.

busMonitorFunction: A specialization of the "customFunction" element for describing bus monitoring (pool-level).

C

calibrationTable: A use-level element for describing the calibration table associated with a particular transducer or other instrument.

card: A specialization of the "instrument" element for describing cards. A card in IHAL is an instrument that cannot operate stand-alone. It must be connected to another instrument in order to function.

channelUse: A specific implementation of a channel from the instrument pool. The channelUse description references a channel from the pool, specifies a specific channel number, and assigns values to settings on that channel.

chargeAmplifierSensor: A specialization of the "transducer" element for describing charge amplifier sensors (pool-level).

configuration: Container for multiple instrumentation graphs. Defines a single configuration or project.

connection: A use-level element used to describe a connection between two instruments in an instrumentationGraph.

currentExcitationFunction: A specialization of the "customFunction" element for describing current excitation (pool-level).

currentLoopOutputSensor: A specialization of the "transducer" element for describing current loop output sensors (pool-level).

customAttribute: A pool-level element for defining a generic attribute associated with a function. Each attribute may be either configurable or fixed, and may be either numeric, string, Boolean, or reference. If configurable, the attribute element will define which values are valid. Each specialized function description in IHAL will contain specializations of the "customAttribute" element for specific attributes such as "gain", "offset", etc.

customFunction: A pool-level element for defining generic instrumentation functions that don't fit into one of the specific specializations. A function may be composed of 0 or more attributes and 0 or more sub-functions.

customHardwareChannel: A pool-level element for describing a generic hardware channel that does not fit into any of the specific specializations. A channel contains a "multiplicity" element that defines how many identical channels the device has. A channel is composed of one or more functions.

D

dataRecorderFunction: Specialization of the "customFunction" element (pool-level). This is a channel-level function for describing the recording of data from a specific source. See also recorderReproducerFunction.

dataRecordingChannel: Specialization of the "customHardwareChannel" element for describing a data recorder channel (pool-level).

dataStreamPool: Contains the global list of data streams and buses. This element makes use of constructs from the integrated Network Enhanced Telemetry (iNET) program's MDL.

dataStreamUse: A use-level element used to define which measurements from a data stream are to be sampled by a bus monitor.

dau: A specialization of the "instrument" element for describing data acquisition units (pool-level).

dauFunction: Specialization of the "customFunction" element for describing the functions performed by a data acquisition unit (pool-level).

E

errorList: Top-level container for the IHAL error schema. An errorList may be returned as a response to any API function call.

F

formatUse: A specific implementation of a data format from the instrument pool. The formatUse element references a data format from the pool, specifies a format number, assigns values to settings associated with that format, and defines the measurements encoded in the format.

H

highLevelVoltageSensor: A specialization of the "transducer" element for describing high-level voltage sensors (pool-level).

I

ihal: The top-level element in a complete IHAL description

instrument: A pool-level element for describing a device that does not fit into one of the specific specializations. The pool-level instrument element defines the physical attributes of the hardware, the functionality it provides, and the settings available.

instrumentationGraph: A set of interconnected instrumentation hardware (instrumentUse elements). Separate instrumentationGraph elements could be used to describe the airborne system vs. the ground system, for example.

instrumentPool: Container for all pool-level device descriptions. The instrumentPool contains descriptions of all available instruments.

instrumentUse: A specific implementation of an instrument from the pool. The instrumentUse description references an instrument from the pool and assigns specific values to settings.

L

lvdtrvdtSensor: A specialization of the "transducer" element for describing linear/rotary variable differential transformers (pool-level).

M

masterControllerFunction: Specialization of the "customFunction" element for describing the functionality of a master controller (pool-level).

measurementPool: Contains a global list of measurements.

P

potentiometricVoltageDivider: A specialization of the "transducer" element for describing potentiometric voltage dividers (pool-level).

programmingStatus: A use-level element that describes the current status of programming the current configuration to the physical hardware. Values may be either "COMPLETE", "IN_PROGRESS", "ERROR", or "NOT_STARTED".

R

recorderReproducer: A specialization of the "instrument" element for describing a recorder/reproducer (pool-level).

recorderReproducerFunction: A specialization of the "customFunction" element for describing the function of recording/reproducing data associated with one or more channels to/from some medium.

restrictedAttribute: A use-level element that redefines the set of valid values for a configurable attribute from the pool. Restricted attributes are used whenever the valid values for a setting change as a result of the current configuration.

resistanceSensor: A specialization of the "transducer" element for defining resistance sensors (pool-level).

rtdSensor: A specialization of the "transducer" element for describing resistance temperature detectors (pool-level).

S

setAttribute: A use-level element that assigns a value to a configurable attribute from the pool.

statusDataFunction: Specialization of the "customFunction" element for describing the function of emitting status words (pool-level).

strainGauge: A specialization of the "transducer" element for describing strain gauges (pool-level).

sstDataEncoderFunction: A specialization of the "customFunction" element for describing a serial streaming telemetry (SST) data encoder.

sstDataFormat: Pool-level concept for describing an SST format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

sstFormatUse: A specialization of the "formatUse" element for describing PCM output formats. sstFormatUse makes use of TMATS XML constructs.

T

thermistor: A specialization of the "transducer" element for describing thermistors (pool-level).

thermocouple: A specialization of the "transducer" element for describing thermocouples (pool-level).

tmNSDataEncoderFunction: Specialization of the "customFunction" element for describing the functionality of a Telemetry Network Standard (TmNS) data encoder (pool-level).

tmNSDataFormat: Pool-level concept for describing a TmNS data format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

transducer: A specialization of the "instrument" element for describing generic transducers (pool-level)

U

unitsPool: Container for a global list of engineering units. Units can be built by combining other units and SI units. Unit descriptions make use of constructs from the iNET program's MDL.

V

voltageAmplificationFunction: A specialization of the "customFunction" element for describing voltage amplification (pool-level).

voltageExcitationFunction: A specialization of the "customFunction" element for describing voltage excitation (pool-level).

X

xidMLNetworkDataEncoderFunction: A specialization of the "customFunction" element for describing the functionality of a non-TmNS network data encoder (pool-level).

xidMLNetworkDataFormat: Pool-level concept for describing a non-TmNS network data format that may be created by an instrument. Formats in IHAL are similar to channels in that they have a multiplicity and are composed of functions.

xidMLNetworkFormatUse: A specialization of the "formatUse" element for describing non-TmNS network data formats. This element makes use of constructs from XidML.

9.7.6 Complete IHAL API Specification

9.7.6.1 API Implementation Requirements

The IHAL API must be implemented as a RESTful web service. All functions must have a common base path (e.g., http://10.10.1.1:8080/ihalapi/). This base path is referred to as "<Vendor API Location>" in this document.

All inputs are provided as the payload of the function call, with no named parameters or URL encoding. That is, inputs will NOT be part of the URL (e.g., http://.../?ihal=<ihal>... is NOT allowed).

9.7.6.2 Errors

All functions in the below specification may optionally return an <ihal:errorList> element instead of the defined response. The error list is intended to provide the user with a description of problems encountered if the requested function could not be performed.

9.7.6.3 API Functions

The following sections describe the functions that must be included as part of any IHAL API implementation.

9.7.6.3.1 Retrieve a Vendor's Pool

This method is used by a client to retrieve some part of a vendor's pool description. There are multiple URLs for this function to retrieve different parts of the pool, as shown in Table 9-13.

Table 9-13. Retrieve a Vendor's Pool

URL	<Vendor API Location>/pool/units to retrieve the units pool
	<Vendor API Location>/pool/instrument to retrieve the instrument pool
	<Vendor API Location>/pool/measurement to retrieve the global measurement list
	<Vendor API Location>/pool/measurement/<deviceID> to retrieve the list of measurements available to a particular device (e.g., a data encoder)
	<Vendor API Location>/pool/dataStream to retrieve the global list of data streams (e.g., buses)
	<Vendor API Location>/pool/dataStream/<deviceID> to retrieve the global list of data streams (e.g., buses) available to a particular device
HTTP Verb	GET
Function Input	None
Return Value	Complete IHAL <instrumentPool>, <unitsPool>, <measurementPool>, or <dataStreamPool> element.

9.7.6.3.2 Retrieve the List of Available Configurations

This function queries the web service for a list of existing instrumentation configurations and is described in Table 9-14.

Table 9-14. Retrieve the List of Available Configurations	
URL	<vendor API Location>/configurations/
HTTP Verb	GET
Function Input	None
Return Value	A partial <ihal> specification containing 0 or more EMPTY <configuration> elements, each with only the basic required information. No pools should be returned.

9.7.6.3.3 Retrieve a Specific Configuration

This function uses the ID of a configuration returned from the previous function call to request the complete description of that configuration. It is illustrated in Table 9-15.

Table 9-15. Retrieve a Specific Configuration	
URL	<vendor API Location>/configurations/<configurationID>. <configurationID> contains a unique identifier returned as the "id" attribute from a call to "Retrieve a list of Configurations"
HTTP Verb	GET
Function Input	None
Return Value	A complete IHAL <configuration> element

9.7.6.3.4 Change the Value of a Configurable Attribute

This function is used to change the values of settings on a particular device, as shown in Table 9-16. The desired setting changes are passed via IHAL, and a description of everything that has changed as a result of these setting changes is returned as an IHAL description.

Table 9-16. Change the Value of a Configurable Attribute	
URL	<vendor API Location>/configurations/<configurationID>/ <configurationID> contains a unique identifier returned as the "id" attribute from a call to "Retrieve a list of Configurations"
HTTP Verb	PUT
Function Input	A partial <configuration> element. This element contains only the settings that the user wishes to modify.
Return Value	The impact: A partial IHAL <configuration> element containing only the new settings for everything that has changed: • The new values for the settings the user requested (may or may not match the original request); • Any additional settings that changed as a result; • Any attribute "restrictions" that changed as a result.

9.7.6.3.5 Create a New Configuration

This function is used to create a new configuration in the vendor's system. It is described in Table 9-17. A partial or complete IHAL "configuration" element is passed as input, and then

the vendor responds with a validated "configuration" element that matches (as closely as possible) the input. The vendor may change use-level IDs.

Table 9-17. Create a New Configuration	
URL	<vendor API Location>/configurations/
HTTP Verb	POST
Function Input	A partial or complete <configuration> element.
Return Value	A validated <configuration> description that matches (as closely as possible) the input <configuration>. Use-level ID values may change.

9.7.6.3.6 Add a Device to a Configuration

This function is used to add a device from the pool to an existing configuration in the vendor's system. The function is depicted in Table 9-18. A partial or complete IHAL "instrumentUse" element is passed as input, and then the vendor responds with a valid "configuration" element that includes the new device. The vendor may change use-level IDs.

Table 9-18. Add a Device to a Configuration	
URL	<vendor API Location>/configurations/<configurationID>/devices
HTTP Verb	POST
Function Input	A partial or complete <instrumentUse> element.
Return Value	A valid <configuration> description that includes the new device. Use-level ID values may change.

9.7.6.3.7 Remove a Device from a Configuration

This function is used to remove an instrumentUse from an existing configuration in the vendor's system. It is illustrated in Table 9-19. The ID of the instrumentUse element is included in the URL, and the HTTP "DELETE" verb tells the system to remove that device. The vendor must respond with a valid configuration description, with the device removed.

Table 9-19. Remove a Device from a Configuration	
URL	<vendor API Location>/ configurations/<configurationID>/devices/<instrumentUseID>
HTTP Verb	DELETE
Function Input	None
Return Value	A valid <configuration> description with the device removed

9.7.6.3.8 "Program" the Hardware

This function is used to tell the vendor's configuration engine to load a specific configuration onto the affected hardware. It is illustrated in Table 9-20. The vendor responds with a <configuration> description that includes updated values for the programming status.

Table 9-20. "Program" the Hardware	
URL	<vendor API Location>/ configurations/<configurationID>/programRequest

HTTP Verb	POST
Function Input	None
Return Value	A partial <configuration> description with the current programming status of affected devices updated.

9.7.6.3.9 Add a New format to a Data Encoder

This function is used to add a new data format to a data encoder. This can be either a PCM (SST) format or a non-TmNS network format. The client sends a partial or complete description of the format, and the vendor's service responds with an updated <configuration> element containing ONLY items that have changed (including the addition of the new format). The function is shown in Table 9-21.

Table 9-21. Add a New Format to a Data Encoder

URL	<vendor API Location>/ configurations/<configurationID>/<instrumentUseID>/formats
HTTP Verb	POST
Function Input	A complete or partial format "use" description (i.e., sstFormatUse or xidMLNetworkFormatUse)
Return Value	An updated <configuration> element containing the new format as well as any settings in the configuration that have changed as a result.

9.7.6.3.10 Add a Measurement to an Existing Format

This function is used to add a new measurement to an existing data format. The function is illustrated in Table 9-22. The input uses either a XidML <Mapping> element or a TMATS <Measurement> element to describe the measurement and where it should be placed in the format. The vendor's service responds with a <configuration> element that contains a complete description of the affected format as well as any settings changes that have occurred as a result.

Table 9-22. Add a Measurement to an Existing Format

URL	<vendor API Location>/ configurations/<configurationID>/<formatUseID>/measurements
HTTP Verb	POST
Function Input	A description of the measurement and its location in the format. This will be either a XidML <Mapping> element or a TMATS-XML <Measurement> element.
Return Value	An updated <configuration> element containing the modified format as well as any settings in the configuration that have changed as a result.

9.7.6.3.11 Remove a Measurement from a Format

This function is used to remove a measurement from an existing data format. The function is illustrated in Table 9-23. The client specifies the ID of the measurement in the URL. The vendor's service must remove ALL instances of this measurement from the specified format. The service must then respond with a <configuration> element that contains a complete description of the affected format as well as any settings changes that have occurred as a result.

Table 9-23. Remove a Measurement From a Format	
URL	<vendor API Location>/ configurations/<configurationID>/<formatUseID>/<measurementID>
HTTP Verb	DELETE
Function Input	None
Return Value	An updated <configuration> element containing the modified format as well as any settings in the configuration that have changed as a result.

APPENDIX 9-A

Application of the Telemetry Attributes Transfer Standard

Elements of the telemetry attributes transfer process allow for the interchange of telemetry attributes between vehicle instrumentation organizations (the source) and the telemetry ground stations (the destination). Interchange may also take place between ranges. The following are typical elements of this process:

a. Data entry system

b. Source database

c. Export program

d. Interchange medium [this standard]

e. Import program

f. Destination database

g. Telemetry setup system

h. Telemetry processing equipment.

Figure A-1 depicts these elements, which are defined after the figure.

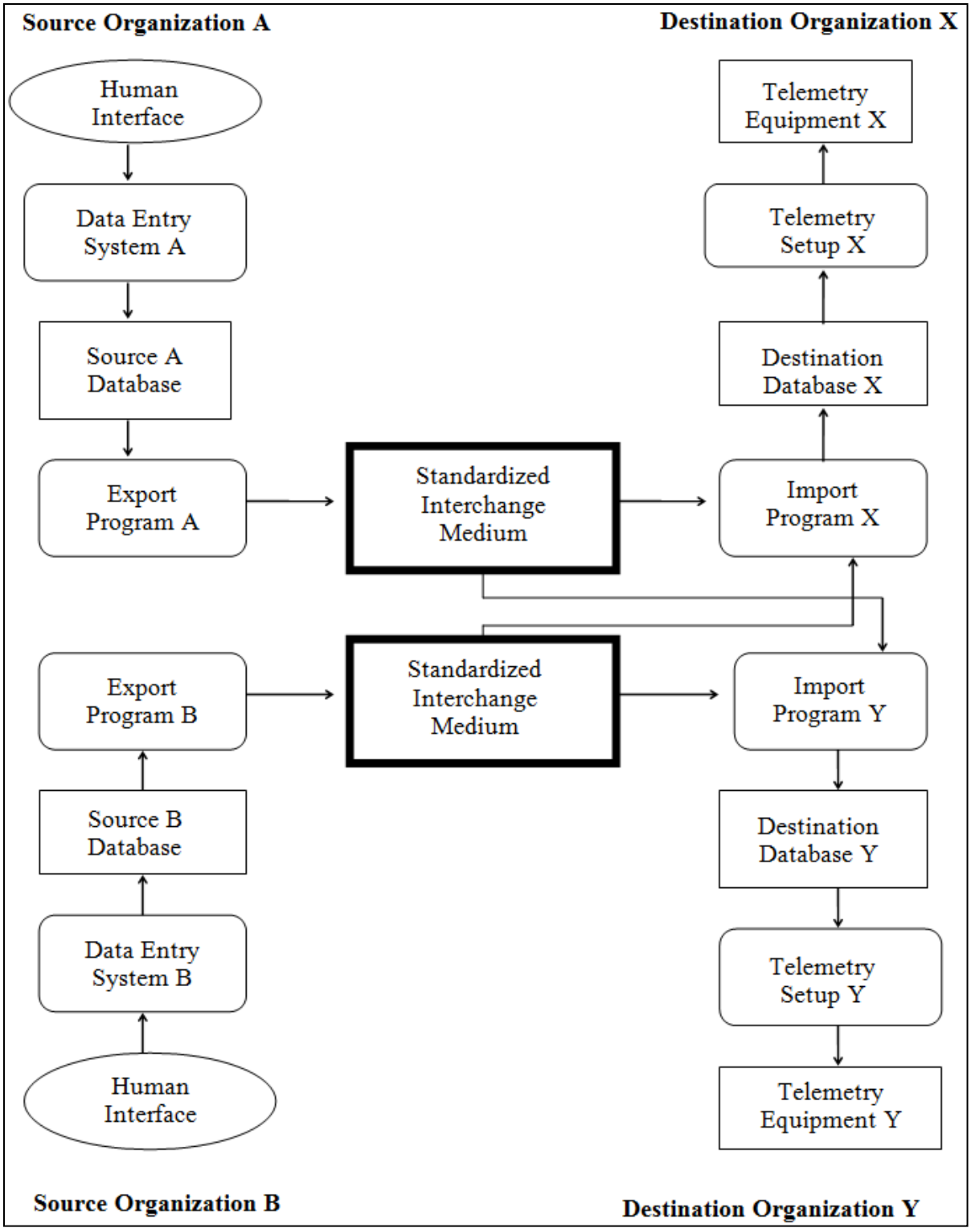


Figure A-1. Typical Elements of the Telemetry Attributes Transfer Process

A.1. Data Entry System

The data entry system is the source organization's human interface where telemetry attributes are entered into a computer-based system (not affected by this standard).

A.2. Source Database

The source database is where telemetry attributes are maintained in a form appropriate to the local organization's needs (not affected by this standard).

A.3. Export Program

The export program converts the telemetry attributes from the source database format to the format defined by this standard and stores them on the interchange medium.

A.4. Interchange Medium

The interchange medium contains the telemetry attributes being transferred from the source organization to the destination organization. Format and contents are defined by this standard.

A.5. Import Program

The import program reads the standardized interchange medium and converts the attributes to the destination database format in accordance with local needs, system characteristics, and limitations.

A.6. Destination Database

The destination database is where telemetry attributes are maintained in a form suitable to the local ground station's needs (not affected by this standard).

A.7. Telemetry Setup System

The telemetry setup system accesses the destination database to load the telemetry processing equipment (not affected by this standard).

A.8. Telemetry Processing Equipment

The telemetry processing equipment is where the attributes will ultimately be used to properly handle the data being transmitted (not affected by this standard).

The interchange medium is intended as a standard means of information exchange. The source and destination organizations are not constrained by this standard as to how the attributes are stored, viewed, used, or maintained.

To use the attribute transfer standard, import and export software must be developed. Once in place, these programs should eliminate the need for test item or project-specific software at either the supplying (source) organizations or the processing (destination) organizations.

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APPENDIX 9-B

Telemetry Attributes Transfer Standard Cover Sheet

Each attribute transfer file (disk or tape) should be accompanied by a cover sheet describing the originating agency's computer system used to construct the attribute file. The recommended format for this cover sheet is given below as Figure B-1.

Telemetry Attributes Transfer Standard

Date: MM\DD\YY

From: Name

Address

Telephone

To: Name

Address

Telephone

Originating computer system:

Computer make and model:

Medium characteristics:

Description:

Comments:

Figure B-1. Sample Cover Sheet for Attribute Transfer Files

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APPENDIX 9-C

Telemetry Attributes Transfer Standard Format Example

C.1. Introduction

The following example is for illustrative purposes and is by no means a complete attributes file; it is representative of the types of information likely to be transferred. Many attributes are purposely omitted to simplify the example. In some of the groups, only those entries necessary to link to other groups are provided. Attributes that link the various groups together are indicated in **boldface**.

C.2. Overview of Example

Selected attributes are described in text form as an aid to following the example. All text that describes the example is *printed in italics*. All text that is part of the example file is printed in plain text.

The example file being transferred consists of the attributes of a single RF data source and a stored data source containing two channels of data. The RF data source is a PCM signal, which contains an embedded asynchronous wave train. The two recorded channels of data are PCM signals: one is an aircraft telemetry stream, and the other is a radar data telemetry stream. Figure C-1 shows the example file in terms of the attribute groups and their interrelationships. Refer to the attribute tables while reviewing the example.

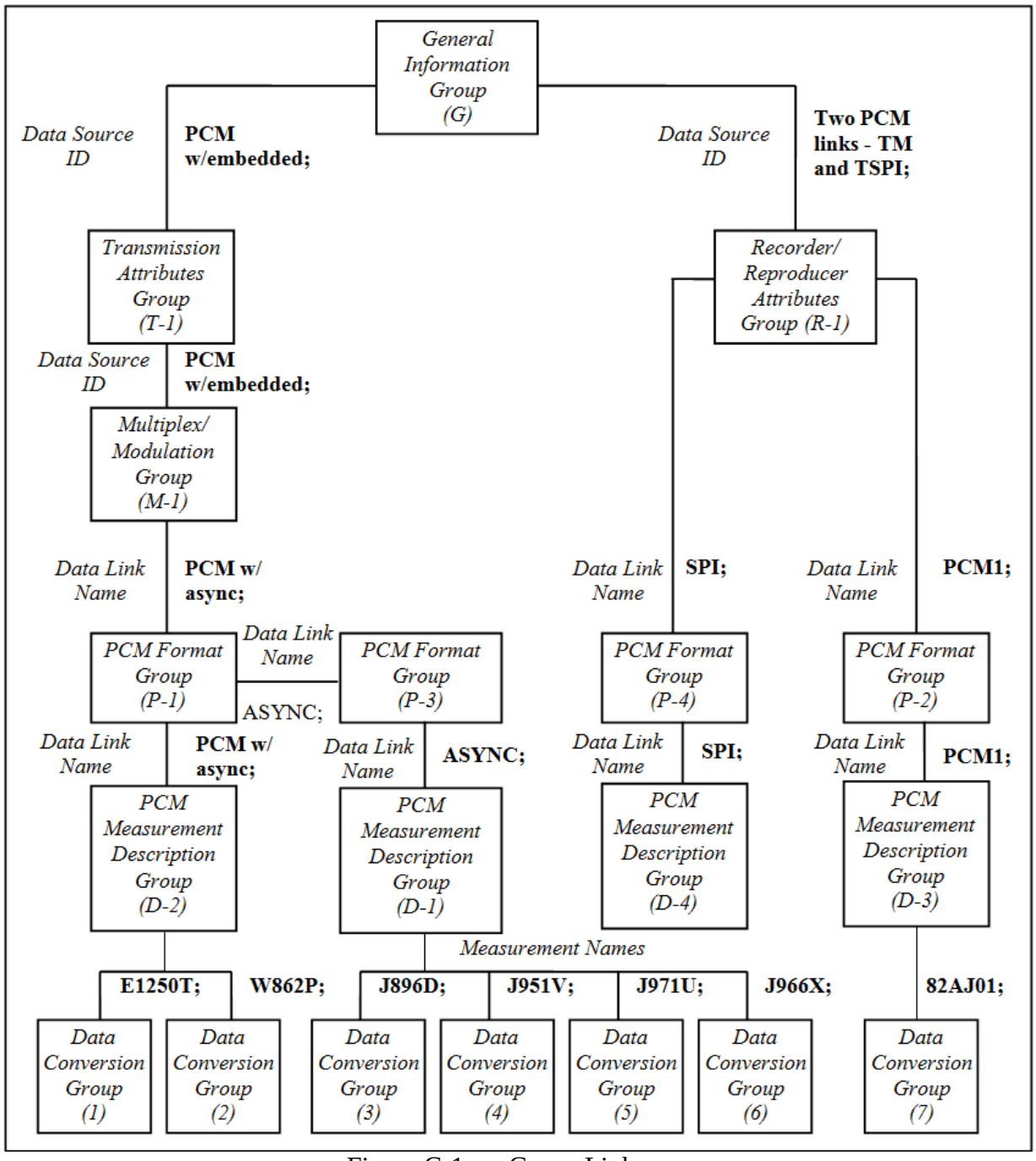

Figure C-1. Group Linkages

General Information Group (G)

Program name, test name, origination date, revision number: 0, test number: 13.

G\PN: TMATS example; G\TA: Wright Flyer; G\OD: 07-12-1903; G\RN:0; G\TN:13;
G\POC1-1: Wilbur; G\POC2-1: Bikes,LTD; G\POC3-1: Dayton; G\POC4-1: 555-1212;

Live data source.

G\DSI-1:PCM w/embedded; G\DST-1:RF;

Data storage source.

G\DSI-2:Two PCM links - TM & TSPI; G\DST-2:STO;
G\COM: I hope this flies.; G\POC1-2: Orville;
G\POC2-2:Bikes,LTD; G\POC3-2: Dayton; G\POC4-2: 555-1212;

Transmission Attributes Group (T-1)

Frequency: 1489.5, RF bandwidth: 100, data bandwidth: 100; not encrypted, modulation type: FM, total carrier modulation: 500, no subcarriers, transmit polarization: linear.

T-1\ID:PCM w/embedded; T-1\RF1:1489.5; T-1\RF2:100; T-1\RF3:100;
T-1\RF4:FM; T-1\RF5:500; T-1\SCO\N:NO; T-1\AN2:LIN;
T-1\AP\POC1: Pat Tern; T-1\AP\POC2:Transmissions,Inc.;
T-1\AP\POC3:Amityville,NY; T-1\AP\POC4:800-555-1212;

Recorder-Reproducer Attributes Group (R-1)
R-1\ID:Two PCM links - TM & TSPI;
R-1\R1:Recorded Data; R-1\TC1:MD;

Two channels of data, manufacturer: ZZ; model: 13, original: yes.

R-1\RI1:ZZ; R-1\RI2:13;R-1\N:2; R-1\RI3:Y;
R-1\RI4:07-12-2011-07-55-59; R-1\POC1:Mr. Tenn; R-1\POC2:Data Creations;
R-1\POC3:Anywhere,Ttown; R-1\POC4:555-1212;

Channel ID 2 contains aircraft telemetry PCM (w/subframe fragmented)

R-1\TK1-1:2;
R-1\DSI-1:PCM w/subframe fragmented;
R-1\CDT-1:PCMIN; **R-1\CDLN-1:PCM1;**

Channel ID 4 contains Space Position Information via PCM link

R-1\TK1-2:4; R-1\DSI-2:Space Position Information;
R-1\CDT-2:PCMIN; **R-1\CDLN-2:SPI;**

Multiplex/Modulation Group (M-1)

Baseband type: PCM, modulation sense: POS, baseband data: PCM, low pass filter type: constant amplitude

M-1\ID:PCM w/embedded; M-1\BB1:PCM; M-1\BB2:POS; M-1\BSG1:PCM;
M-1\BSF2:CA;
M-1\BB\DLN:PCM w/async;

PCM Format Attributes Groups (P)

P-1 is a live PCM signal and contains the asynchronous wave train (see Table C-1).

P-2 is a recorded signal (see Table C-2).

P-3 is the asynchronous wave train (see Table C-3).

P-4 is a recorded signal.

Table C-1. PCM Format for PCM w/ASYNC

	Sync	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	• • •	39	40	41	42
1	20 bits	ID Counter					Embedded Format (Words 6-10)				8 Bits	12 Bits						a			
2																		a			
3																		a			
4																		a			
5																		a			
6																		a			
7																		a			
8																		a			b
•																		•			
•																		•			
•																		•			
16																		a			

Major frame characteristics:

One major frame = 16 minor frames
Word lengths = 10 bits (default value) except Word 10 has 8 bits and Word 11 has 12 bits

a = measurement E1250T in word position 39
b = measurement W862P in word position 42, frame position 8.

PCM Format Group = P-1
PCM Measurement Description Group = D-2
Data Link Name = PCM w/async

Table C-2. PCM Format for PCM1

	Sync	1	2	3 ••• 12	13	14	••• 113	114 ••• 120	121	122 ••• 276
1	30 bits				ID Counter					
2										
3										
4										
5							M		L	
•••										
32									6 Bits	4 Bits
•••										
37							M		L	
•••										
64										

Major frame characteristics:

One major frame = 64 minor frames
ID counter counts 0 - 63
Word lengths = 10 (default value) except Word 121 has 6 bits and Word 122 has 4 bits

Measurement 82AJ01 is 16 bits, which is fragmented with the 10 msbs indicated as M and the 6 lsbs as L.
Measurement 82AJ01 occurs twice in the major frame.
The first location is in word positions 113 and 121, frame position 5.
The second location is in word positions 113 and 121, frame position 37.

PCM Format Group = P-2
PCM Measurement Description Group = D-3
Data Link Name = PCM1

Table C-3. PCM Format for ASYNC

	Sync	1	2	3	•••	11	•••	14	•••	20	•••	29	•••	33	•••	39	•••	45	46	47	48	49
1	16 Bits	ID Counter	a	b	•••	a	•••	c	•••	a	•••	a	•••	a	•••		•••			a		
2			a		•••	a	•••		•••	a	•••	a	•••	a	•••	c	•••			a		
3			a		•••	a	•••		•••	a	•••	a	•••	a	•••		•••	d		a		

Major frame characteristics:
One major frame = 3 minor frames
Word lengths = 16 bits (default value)

a = measurement J971U, supercommutated in word positions 2, 11, 20, 29, 33, and 47
b = measurement J951V in word position 3, frame position 1
c = measurement J896D in two locations: word position 14, frame position 1 and word position 39, frame position 2
d = measurement J966X in word position 45, frame position 3

PCM Format Group = P-3
PCM Measurement Description Group = D-1
Data Link Name = ASYNC

(Start of P-1)

Live PCM signal (host wave train): Class I

P-1\DLN:PCM w/async; P-1\D1:NRZ-L; P-1\D2:44000; P-1\D3:U;
P-1\D4:N; P-1\D6:N; P-1\D7:N; P-1\TF:ONE;

10 bits default word length, 16 minor frames/major frame, 43 words/frame

P-1\F1:10; P-1\F2:M; P-1\F3:NO; P-1\MF\N:16; P-1\MF1:43;
P-1\MF2:440; P-1\MF3:FPT; P-1\MF4:20;
P-1\MF5: 01111010011010110001; P-1\SYNC1:1; P-1\SYNC2:0;
P-1\SYNC3:1;P-1\SYNC4:0;

Word position #10, 8 bits, Word position #11, 12 bits

P-1\MFW1-1:10; P-1\MFW2-1:8; P-1\MFW1-2:11; P-1\MFW2-2:12;

One subframe ID counter in word position 1

P-1\ISF\N:1; P-1\ISF1-1:1; P-1\ISF2-1:ID; P-1\IDC1-1:1;

msb starting bit location: 7, ID counter length: 4

P-1\IDC3-1:7; P-1\IDC4-1:4; P-1\IDC5-1:M;
P-1\IDC6-1:0; P-1\IDC7-1:1; P-1\IDC8-1:15; P-1\IDC9-1:16;
P-1\IDC10-1:INC;

Asynchronous embedded wave train information

Data Link Name (to be referenced in the format definition of the asynchronous wave train) is ASYNC.

Five contiguous minor frame word positions starting at location 6.

P-1\AEF\N:1; **P-1\AEF\DLN-1:ASYNC;** P-1\AEF1-1:5; P-1\AEF2-1:CW;
P-1\AEF3-1-1:6;

(End of P-1)

(Start of P-2)

Recorded PCM signal format attributes.

Data Link Name is PCM1, Data Format is NRZ-L, Bit rate is 2 Mbit/sec, Unencrypted, Normal polarity, class I, Common word length is 10, msb first, No parity, 64 minor frames per major frame, 277 words per minor frame, Sync pattern length is 30. Word position 121 is 6 bits. Word position 122 is 4 bits.

P-2\DLN:PCM1;P-2\D1:NRZ-L; P-2\D2:2000000; P-2\D3:U; P-2\D4:N;
P-2\TF:ONE; P-2\F1:10; P-2\F2:M; P-2\F3:NO; P-2\MF\N:64;
P-2\MF1:277; P-2\MF4:30; P-2\MF5:10111000000110011111010110101 1; P-2\SYNC1:1;
P-2\MFW1-1:121; P-2\MFW2-1:6; P-2\MFW1-2:122;P-2\MFW2-2:4;

One subframe ID counter named 1. Sync type is ID counter. ID counter location is 13. ID counter msb location is 5. ID counter length is 6. ID counter transfer order is msb first. ID counter initial value is 0. ID counter initial frame is 1. ID counter end value is 63. ID counter end frame is 64. ID counter is increasing.

P-2\ISF\N:1; P-2\ISF1-1:1; P-2\ISF2-1:ID; P-2\IDC1-1:13;
P-2\IDC3-1:5; P-2\IDC4-1:6; P-2\IDC5-1:M;
P-2\IDC6-1:0; P-2\IDC7-1:1; P-2\IDC8-1:63; P-2\IDC9-1:64;
P-2\IDC10-1:INC;

(End of P-2)

(Start of P-3)

Asynchronous wave train PCM format attributes.

Data Link Name: ASYNC

Class I, Common word length: 16, lsb transfer order, no parity, 3 minor frames per major frame, 50 words/minor frame, 800 bits per minor frame, fixed pattern synchronization, 16 bit sync pattern.

P-3\DLN:ASYNC; P-3\TF:ONE; P-3\F1:16; P-3\F2:L; P-3\F3:NO;
P-3\MF\N:3; P-3\MF1:50; P-3\MF2:800; P-3\MF3:FPT; P-3\MF4:16;
P-3\MF5: 1111100110110001; P-3\SYNC1:1;

ID counter in word position 1.

P-3\ISF\N:1; P-3\ISF1-1:2; P-3\ISF2-1:ID; P-3\IDC1-1:1;
P-3\IDC3-1:15; P-3\IDC4-1:2; P-3\IDC5-1:L;
P-3\IDC6-1:0; P-3\IDC7-1:1; P-3\IDC8-1:2; P-3\IDC9-1:3;
P-3\IDC10-1:INC;

(End of P-3)

(Start of P-4)

P-4\DLN:SPI;

(End of P-4)

PCM Measurement Description (D)

D-1 contains the measurements that make up the asynchronous wave train,

D-2 contains the measurements that make up the live PCM signal (that hosts the asynchronous wave train),

D-3 contains the measurements that make up one of the recorded PCM signals, and

D-4 contains the measurements that make up the other recorded PCM signal.

(Start of D-1)

Asynchronous Wave Train: One measurement list, 4 measurements

D-1\DLN:ASYNC; D-1\ML\N:1; D-1\MLN-1:JUST ONE; D-1\MN\N-1:4;

Measurement Name: J896D, lsb first.

2 locations: word 14, frame 1 and word 39, frame 2.

D-1\MN-1-1:J896D; D-1\MN3-1-1:L; D-1\LT-1-1: WDFR;
D-1\MML\N-1-1:2: D-1\MNF\N-1-1-1:1: D-1\WP-1-1-1-1:14; D-1\WI-1-1-1-1:0;
D-1\FP-1-1-1-1:1; D-1\FI-1-1-1-1:0; D-1\WFM-1-1-1-1:FW; D-1\MNF\N-1-1-2:1:
D-1\WP-1-1-2-1:39; D-1\WI-1-1-2-1:0; D-1\FP-1-1-2-1:2; D-1\FI-1-1-2-1:0;
D-1\WFM-1-1-2-1:FW;

Measurement Name: J951V, lsb first, default parity, word 3, frame 1.

D-1\MN-1-2:J951V; D-1\MN1-1-2:DE; D-1\MN2-1-2:D; D-1\MN3-1-2:L;
D-1\LT-1-2: WDFR; D-1\MML\N-1-2:1: D-1\MNF\N-1-2-1:1: D-1\WP-1-2-1-1:3;
D-1\WI-1-2-1-1:0; D-1\FP-1-2-1-1:1; D-1\FI-1-2-1-1:0;
D-1\WFM-1-2-1-1:1111111100000000;

Measurement Name: J971U, lsb first,

supercommutated at 6 word positions: 2, 11, 20, 29, 33, and 47.

D-1\MN-1-3:J971U; D-1\MN1-1-3:DE; D-1\MN2-1-3:D; D-1\MN3-1-3:L;
D-1\LT-1-3: WDFR; D-1\MML\N-1-3:6:
D-1\MNF\N-1-3-1:1: D-1\WP-1-3-1-1:2; D-1\WI-1-3-1-1:0; D-1\FP-1-3-1-1:1;
D-1\FI-1-3-1-1:1; D-1\WFM-1-3-1-1:FW;
D-1\MNF\N-1-3-2:1: D-1\WP-1-3-2-1:11; D-1\WI-1-3-2-1:0; D-1\FP-1-3-2-1:1;
D-1\FI-1-3-2-1:1; D-1\WFM-1-3-2-1:FW;
D-1\MNF\N-1-3-3:1: D-1\WP-1-3-3-1:20; D-1\WI-1-3-3-1:0; D-1\FP-1-3-3-1:1;
D-1\FI-1-3-3-1:1; D-1\WFM-1-3-3-1:FW;
D-1\MNF\N-1-3-4:1: D-1\WP-1-3-4-1:29; D-1\WI-1-3-4-1:0; D-1\FP-1-3-4-1:1;
D-1\FI-1-3-4-1:1; D-1\WFM-1-3-4-1:FW;
D-1\MNF\N-1-3-5:1: D-1\WP-1-3-5-1:33; D-1\WI-1-3-5-1:0; D-1\FP-1-3-5-1:1;
D-1\FI-1-3-5-1:1; D-1\WFM-1-3-5-1:FW;
D-1\MNF\N-1-3-6:1: D-1\WP-1-3-6-1:47; D-1\WI-1-3-6-1:0; D-1\FP-1-3-6-1:1;
D-1\FI-1-3-6-1:1; D-1\WFM-1-3-6-1:FW;

Measurement Name: J966X, lsb first, word 45, frame 3.

D-1\MN-1-4:J966X; D-1\MN1-1-4:DE; D-1\MN2-1-4:D;
D-1\MN3-1-4:L; D-1\LT-1-4:WDFR; D-1\MML\N-1-4:1: D-1\MNF\N-1-4-1:1:
D-1\WP-1-4-1-1:45; D-1\WI-1-4-1-1:0; D-1\FP-1-4-1-1:3; D-1\FI-1-4-1-1:0;
D-1\WFM-1-4-1-1:FW;

(End of D-1)

(Start of D-2)

Live PCM signal: single measurement list, 2 measurements.

D-2\DLN:PCM w/async; D-2\ML\N:1; D-2\MLN-1:JUST ONE; D-2\MN\N-1:2;

Measurement name: E1250T, unclassified, unsigned, msb first, word 39.

D-2\MN-1-1:E1250T; D-2\MN1-1-1:DE; D-2\MN2-1-1:D;
D-2\MN3-1-1:M; D-2\LT-1-1:WDFR;
D-2\MML\N-1-1:1: D-2\MNF\N-1-1-1:1: D-2\WP-1-1-1-1:39; D-2\WI-1-1-1-1:0;
D-2\FP-1-1-1-1:1; D-2\FI-1-1-1-1:1; D-2\WFM-1-1-1-1:FW;

Measurement name: W862P, unclassified, msb first, word 42, frame 8, full word.

D-2\MN-1-2:W862P; D-2\MN1-1-2:DE; D-2\MN2-1-2:D; D-2\MN3-1-2:M;
D-2\LT-1-2: WDFR; D-2\MML\N-1-2:1: D-2\MNF\N-1-2-1:1: D-2\WP-1-2-1-1:42;
D-2\WI-1-2-1-1:0; D-2\FP-1-2-1-1:8; D-2\FI-1-2-1-1:0; D-2\WFM-1-2-1-1:FW;

(End of D-2)

(Start of D-3)

Recorded PCM signal: single measurement list: 1 measurement.

D-3\DLN:PCM1; D-3\MLN-1:ONLY ONE; D-3\MN\N-1:1;

Measurement name: 82AJ01, fragmented, in 2 locations: words 113 and 121, frame 5 and words 113 and 121, frame 37. Word 113 contains the most significant fragment and word 121 contains the least significant fragment.

D-3\MN-1-1:82AJ01; D-3\LT-1-1: WDFR; D-3\MML\N-1-1:1; D-3\MNF\N-1-1-1:2;
D-3\WP-1-1-1-1:113; D-3\WI-1-1-1-1:0; D-3\FP-1-1-1-1:5; D-3\FI-1-1-1-1:32;
D-3\WFM-1-1-1-1:FW;
D-3\WP-1-1-1-2:121; D-3\WI-1-1-1-2:0; D-3\FP-1-1-1-2:5; D-3\FI-1-1-1-2:32;
D-3\WFM-1-1-1-2:FW;

(End of D-3)

(Start of D-4)

Recorded PCM signal

D-4\DLN:SPI;

(End of D-4)

Data Conversion Groups (C)

C-1 and C-2 are measurements that are part of the live PCM signal (see also D-2).

C-3, C-4, C-5, and C-6 are from the asynchronous wave train (see also D-1).

C-7 is from the recorded PCM signal (see also D-3).

Measurement: E1250T, description: Inlet Temp Bellmouth, units: Deg C, binary format: unsigned; high value: 128, low value: –0.4, conversion type: pair sets, number of pair sets: 2, application (polynomial): Yes; order of fit: 1, telemetry value #1: 0, engineering unit value #1: –0.4, telemetry value #2: 1023, engineering unit value #2: 128.

C-1\DCN:E1250T; C-1\MN1:Inlet Temp Bellmouth; C-1\MN3:DEGC;
C-1\BFM:UNS; C-1\MOT1:128; C-1\MOT2:-0.4; C-1\DCT:PRS;
C-1\PS\N:2; C-1\PS1:Y; C-1\PS2:1; C-1\PS3-1:0; C-1\PS4-1:-0.4;
C-1\PS3-2:1023; C-1\PS4-2:128;

Measurement: W862P, description: Fuel Pump Inlet, binary format: unsigned; conversion type: pair sets, number of pair sets: 2, application (polynomial): Yes; order of fit: 1, telemetry value #1: 0, engineering unit value #1: –0.1 telemetry value #2: 1023, engineering unit value #2: 76.7

C-2\DCN:W862P; C-2\MN1:Fuel Pump Inlet; C-2\BFM:UNS;
C-2\DCT:PRS; C-2\PS\N:2; C-2\PS1:Y; C-2\PS2:1; C-2\PS3-1:0;
C-2\PS4-1:-0.1; C-2\PS3-2:1023; C-2\PS4-2:76.7;

Measurement: J896D, description: Altitude, units: Feet, binary format: two's complement; high value: 32768, low value: -32768, conversion type: pair sets; number of pair sets: 2, application (polynomial): Yes, order of fit: 1, telemetry value #1: -32768, engineering unit value #1: -32768, telemetry value #2: 32767, engineering unit value #2: 32767

C-3\DCN:J896D; C-3\MN1: Altitude; C-3\MN3:FEET;
C-3\BFM:TWO; C-3\MOT1:32768; C-3\MOT2:-32768; C-3\DCT:PRS;
C-3\PS\N:2; C-3\PS1:Y; C-3\PS2:1; C-3\PS3-1:-32768;
C-3\PS4-1:-32768; C-3\PS3-2:32767; C-3\PS4-2:32767;

Measurement: J951V, description: Throttle Command, units: VDC, high value: 10.164, low value: -10.164, conversion type: pair sets, number of pair sets: 2, application(polynomial): Yes, order of fit: 1, telemetry value #1: -128, engineering unit value #1: -10.164, telemetry value #2: 127, engineering unit value #2: 10.164, binary format: two's complement

C-4\DCN:J951V; C-4\MN1:Throttle Command; C-4\MN3:VDC;
C-4\MOT1:10.164; C-4\MOT2:-10.164; C-4\DCT:PRS; C-4\PS\N:2;
C-4\PS1:Y; C-4\PS2:1; C-4\PS3-1:-128; C-4\PS4-1:-10.164;
C-4\PS3-2:127; C-4\PS4-2:10.164; C-4\BFM:TWO;

Measurement: J971U; description: DISC, conversion type: discrete, binary format: unsigned.

C-5\DCN:J971U; C-5\MN1:DISC; C-5\DCT:DIS; C-5\BFM:UNS;

Measurement: J966X; description: Discrete, conversion type: discrete, binary format: unsigned.

C-6\DCN:J966X; C-6\MN1:Discrete; C-6\DCT:DIS; C-6\BFM: UNS;

Measurement: 82AJ01, description: LANTZ Norm acceleration, units: MTR/S/S, High value: 1023.97, Low value: -1023.97, conversion type: Coefficients. Order of curve fit: 1, derived from pair sets: No, Coefficient (0): 0, Coefficient(1): 0.03125, binary format: two's complement

C-7\DCN:82AJ01; C-7\MN1:LANTZ Norm acceleration; C-7\MN3:MTR/S/S;
C-7\MOT1:1023.97; C-7\MOT2:-1023.97; C-7\DCT:COE; C-7\CO\N:1;
C-7\CO1:N; C-7\CO:0; C-7\CO-1:.03125; C-7\BFM:TWO;

1.0 XML Version of Example

The entire example is presented beginning on the next page in the XML version of the TMATS. The XML elements are commented with TMATS code names to aid in associating the XML version of the example with the code name version of the example given above.

```
<?xml version="1.0" encoding="utf-8"?>
<Tmats>

    <!-- G Group -->
```

```
    <ProgramName>TMATS example</ProgramName><!--PN-->
    <TestItem>Wright Flyer</TestItem><!--TA-->
    <OriginationDate>1903-07-12</OriginationDate><!--OD must
follow XML date format-->
    <Revision>
        <Number>0</Number><!--RN-->
    </Revision>
    <TestNumber>13</TestNumber><!--TN-->
    <PointOfContact>
        <Name>Wilbur</Name><!--POC1-->
        <Agency>Bikes,LTD</Agency><!--POC2-->
        <Address>Dayton</Address><!--POC3-->
        <Telephone>555-1212</Telephone><!--POC4-->
    </PointOfContact>

    <DataSource Name="PCM w/embedded" Type="RF"><!--DSI-1:PCM
w/embedded;DST-1:RF-->

        <!-- T Group -->
        <TransmissionAttributes>
            <SourceRFAttributes>
                <Frequency>1489.5</Frequency><!--RF1-->
                <RFBandwidth>100</RFBandwidth><!--RF2-->
                <DataBandwidth>100</DataBandwidth><!--RF3-->
                <ModulationType>FM</ModulationType><!--RF4
enumeration-->

<TotalCarrierModulation>500</TotalCarrierModulation><!--RF5-->
                <!--Subcarriers not needed SCO\N:NO-->
                <TransmitAntenna>
                    <Polarization>Linear</Polarization><!--
AN2:LIN-->
                </TransmitAntenna>
                <AntennaPatterns>
                    <PointOfContact>
                        <Name>Pat Tern</Name><!--AP\POC1-->
                        <Agency>Transmissions,Inc.</Agency><!--
AP\POC2-->
                        <Address>Amityville,NY</Address><!--
AP\POC3-->
                        <Telephone>800-555-1212</Telephone><!--
AP\POC4-->
                    </PointOfContact>
                </AntennaPatterns>
            </SourceRFAttributes>
        </TransmissionAttributes>
```

```
        <!-- M Group -->
        <!--M1\ID:PCM w/embedded is implicit-->
        <MultiplexModulationGroup>
            <CompositeSignalStructure>

<SignalStructureType>PCM</SignalStructureType><!--BB1:PCM-->
                <ModulationSense>Positive</ModulationSense><!--
BB2:POS-->
            </CompositeSignalStructure>
            <BasebandSignal>
                <SignalType>PCM</SignalType><!--BSG1:PCM-->
                <LowPassFilter>
                    <Type>Constant Amplitude</Type><!--BSF2:CA--
>
                </LowPassFilter>
                <DataLinkName>PCM w/async</DataLinkName><!--
BB\DLN-->
            </BasebandSignal>
        </MultiplexModulationGroup>

        <DataLink Name="PCM w/async"><!--P-1\DLN-->

            <!-- P Group -->
            <PCMFormatAttributes>
                <InputData>
                    <PCMCode>NRZ-L</PCMCode><!--D1:NRZ-L-->
                    <BitRate>44000</BitRate><!--D2:44000-->
                    <Encrypted>Unencrypted</Encrypted><!--D3:U--
>
                    <Polarity>Normal</Polarity><!--D4:N-->
                    <DataDirection>Normal</DataDirection><!--
D6:N-->
                    <DataRandomized>No</DataRandomized><!--D7:N-
->
                </InputData>
                <Format>
                    <TypeFormat>Class 1</TypeFormat><!--TF:ONE--
>
                    <CommonWordLength>10</CommonWordLength><!--
F1:10-->
                    <WordTransferOrder>MSB
First</WordTransferOrder><!--F2:M-->
                    <Parity>None</Parity><!--F3:NO-->
                    <MinorFrame>

<NumberOfMinorFrames>16</NumberOfMinorFrames><!--MF\N:16-->
```

```
<WordsPerMinorFrame>43</WordsPerMinorFrame><!--MF1:43-->

<BitsPerMinorFrame>440</BitsPerMinorFrame><!--MF2:440-->
                        <SyncType>Fixed Pattern</SyncType><!--
MF3:FPT-->
                        <!--MF4:20 is implicit-->

<SyncPattern>01111010011010110001</SyncPattern><!--
MF5:01111010011010110001-->
                    </MinorFrame>
                </Format>
                <SyncCriteria>
                    <InSync>
                        <Criteria>1</Criteria><!--SYNC1:1-->
                        <NumberOfFSPBits>0</NumberOfFSPBits><!--
SYNC2:0-->
                    </InSync>
                    <OutOfSync>
                        <NumberOfDisagrees>Not
Specified</NumberOfDisagrees><!--SYNC3:1-->
                        <NumberOfFSPBits>0</NumberOfFSPBits><!--
SYNC4:0-->
                    </OutOfSync>
                </SyncCriteria>
                <VariableWordLength>
                    <Word>10</Word><!--MFW1-1-->
                    <Length>8</Length><!--MFW2-1-->
                </VariableWordLength>
                <VariableWordLength>
                    <Word>11</Word><!--MFW1-2-->
                    <Length>12</Length><!--MFW2-2-->
                </VariableWordLength>
                <SubframeSynchronization>
                    <IDCounter><!--ISF\N:1 is implicit-->
                        <Name>1</Name><!--ISF1:1-->
                        <SyncType>ID Counter</SyncType><!--
ISF2:ID-->
                        <Location>1</Location><!--IDC1:1-->

<CounterStartingBitLocation>7</CounterStartingBitLocation><!--
IDC3:7-->
                        <CounterLength>4</CounterLength><!--
IDC4:4-->
                        <TransferOrder>MSB
First</TransferOrder><!--IDC5:M-->
```

```
                        <InitialValue>0</InitialValue><!--
IDC6:0-->

<InitialSubframeNumber>1</InitialSubframeNumber><!--IDC7:1-->
                        <EndValue>15</EndValue><!--IDC8:15-->

<EndSubframeNumber>16</EndSubframeNumber><!--IDC9:16-->

<CountDirection>Increasing</CountDirection><!--IDC10:INC-->
                    </IDCounter>
                </SubframeSynchronization>
                <AsyncEmbeddedFormat>
                    <!--AEF\N:1 is implicit-->
                    <DataLinkName>ASYNC</DataLinkName><!--
AEF\DLN-1:ASYNC-->
                    <Supercom>5</Supercom><!--AEF1-1:5-->
                    <LocationDefinition>Contiguous
Words</LocationDefinition><!--AEF2-1:CW-->
                    <Location>6</Location><!--AEF3-1-1:6-->
                </AsyncEmbeddedFormat>

                <!-- D Group -->
                <!--D-2\DLN:PCM w/async is implicit-->
                <PCMMeasurements>
                        <!--D-2\ML\N:1 is implicit-->
                    <MeasurementList Name="JUST ONE"><!--MLN-
1:JUST ONE-->
                        <!--MN\N-1:2 is implicit-->
                        <Measurement Name="E1250T"><!--MN-1-
1:E1250T-->
                            <Parity>Default</Parity><!--MN1-1-
1:DE-->

<ParityTransferOrder>Default</ParityTransferOrder><!--MN2-1-1:D-
->
                            <MeasurementTransferOrder>MSB
First</MeasurementTransferOrder><!--MN3-1-1:M-->
                            <LocationType>Word and
Frame</LocationType><!--LT-1-1:WDFR-->
                            <!--MML\N-1-1:1 is implicit-->
                            <MeasurementLocation>
                                <!--MNF\N-1-1-1:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>39</StartWord><!-
-WP-1-1-1-1:39-->

<WordInterval>0</WordInterval><!--WI-1-1-1-1:0-->
```

```
<StartFrame>1</StartFrame><!--FP-1-1-1-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-1-1-1:1-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-1-1-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                        <Measurement Name="W862P"><!--MN-1-
2:W862P-->
                            <Parity>Default</Parity><!--MN1-1-
2:DE-->

<ParityTransferOrder>Default</ParityTransferOrder><!--MN2-1-2:D-
->
                            <MeasurementTransferOrder>MSB
First</MeasurementTransferOrder><!--MN3-1-2:M-->
                            <LocationType>Word and
Frame</LocationType><!--LT-1-2:WDFR-->
                            <!--MML\N-1-2:1 is implicit-->
                            <MeasurementLocation>
                                <!--MNF\N-1-2-1:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>42</StartWord><!-
-WP-1-2-1-1:42-->

<WordInterval>0</WordInterval><!--WI-1-2-1-1:0-->

<StartFrame>8</StartFrame><!--FP-1-2-1-1:8-->

<FrameInterval>0</FrameInterval><!--FI-1-2-1-1:0-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-2-1-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                    </MeasurementList>
                </PCMMeasurements>
            </PCMFormatAttributes>

            <!-- C Group -->
            <DataConversionAttributes>
                <Measurement Name="E1250T"><!--C-1\DCN:E1250T-->
                    <Measurand>
                        <Description>Inlet Temp
Bellmouth</Description><!--MN1:Inlet Temp Bellmouth-->
```

```
<EngineeringUnits>DEGC</EngineeringUnits><!--MN3:DEGC-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Unsigned
Binary</BinaryFormat><!--BFM:UNS-->
                    </TelemetryValueDefinition>
                    <OtherInformation>
                        <MeasurementValue>
                            <Low>-0.4</Low><!--MOT2:-0.4-->
                            <High>128.0</High><!--MOT1:128-->
                        </MeasurementValue>
                    </OtherInformation>
                    <DataConversion Type="Pair Sets"><!--
DCT:PRS-->
                        <PairSets>
                            <!--PS\N:2 is implicit-->
                            <Application>Polynomial Curve
Fit</Application><!--PS1:Y-->
                            <OrderOfFit>1</OrderOfFit><!--PS2:1-
->
                            <Pair>
                                <TmValue>0</TmValue><!--PS3-1:0-
->
                                <EuValue>-0.4</EuValue><!--PS4-
1:-0.4-->
                            </Pair>
                            <Pair>
                                <TmValue>1023</TmValue><!--PS3-
2:1023-->
                                <EuValue>128</EuValue><!--PS4-
2:128-->
                            </Pair>
                        </PairSets>
                    </DataConversion>
                </Measurement>

                <Measurement Name="W862P"><!--C-2\DCN:W862P-->
                    <Measurand>
                        <Description>Fuel Pump
Inlet</Description><!--MN1:Inlet Temp Bellmouth-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Unsigned
Binary</BinaryFormat><!--BFM:UNS-->
                    </TelemetryValueDefinition>
```

```
                    <DataConversion Type="Pair Sets"><!--
DCT:PRS-->
                        <PairSets>
                            <!--PS\N:2 is implicit-->
                            <Application>Polynomial Curve
Fit</Application><!--PS1:Y-->
                            <OrderOfFit>1</OrderOfFit><!--PS2:1-
->
                            <Pair>
                                <TmValue>0</TmValue><!--PS3-1:0-
->
                                <EuValue>-0.1</EuValue><!--PS4-
1:-0.1-->
                            </Pair>
                            <Pair>
                                <TmValue>1023</TmValue><!--PS3-
2:1023-->
                                <EuValue>76.7</EuValue><!--PS4-
2:76.7-->
                            </Pair>
                        </PairSets>
                    </DataConversion>
                </Measurement>
            </DataConversionAttributes>
        </DataLink>

        <DataLink Name="ASYNC"><!--P-3\DLN:ASYNC-->

            <!-- P Group -->
            <PCMFormatAttributes>
                <Format>
                    <TypeFormat>Class 1</TypeFormat><!--TF:ONE--
>
                    <CommonWordLength>16</CommonWordLength><!--
F1:16-->
                    <WordTransferOrder>LSB
First</WordTransferOrder><!--F2:L-->
                    <Parity>None</Parity><!--F3:NO-->
                    <MinorFrame>

<NumberOfMinorFrames>3</NumberOfMinorFrames><!--MF\N:3-->

<WordsPerMinorFrame>50</WordsPerMinorFrame><!--MF1:50-->

<BitsPerMinorFrame>800</BitsPerMinorFrame><!--MF2:800-->
                        <SyncType>Fixed Pattern</SyncType><!--
MF3:FPT-->
```

```
                        <!--MF4:16 is implicit-->

<SyncPattern>1111100110110001</SyncPattern><!--
MF5:1111100110110001-->
                    </MinorFrame>
                </Format>
                <SyncCriteria>
                    <InSync>
                        <Criteria>1</Criteria><!--SYNC1:1-->
                    </InSync>
                </SyncCriteria>
                <SubframeSynchronization>
                    <IDCounter><!--ISF\N:1 is implicit-->
                        <Name>2</Name><!--ISF1-1:2-->
                        <SyncType>ID Counter</SyncType><!--ISF2-
1:ID-->
                        <Location>1</Location><!--IDC1-1:1-->

<CounterStartingBitLocation>15</CounterStartingBitLocation><!--
IDC3-1:15-->
                        <CounterLength>2</CounterLength><!--
IDC4-1:2-->
                        <TransferOrder>LSB
First</TransferOrder><!--IDC5-1:L-->
                        <InitialValue>0</InitialValue><!--IDC6-
1:0-->

<InitialSubframeNumber>1</InitialSubframeNumber><!--IDC7-1:1-->
                        <EndValue>2</EndValue><!--IDC8-1:2-->

<EndSubframeNumber>3</EndSubframeNumber><!--IDC9-1:3-->

<CountDirection>Increasing</CountDirection><!--IDC10-1:INC-->
                    </IDCounter>
                </SubframeSynchronization>

                <!-- D Group -->
                <!--D-1\DLN:ASYNC is implicit-->
                <PCMMeasurements>
                        <!--D-1\ML\N:1 is implicit-->
                    <MeasurementList Name="JUST ONE"><!--MLN-
1:JUST ONE-->
                        <!--MN\N-1:4 is implicit-->
                        <Measurement Name="J896D"><!--MN-1-
1:J896D-->
                            <MeasurementTransferOrder>LSB
First</MeasurementTransferOrder><!--MN3-1-1:L-->
```

```
                            <LocationType>Word and
Frame</LocationType><!--LT-1-1:WDFR-->
                            <!--MML\N-1-1:2 is implicit-->
                            <MeasurementLocation>
                                <!--MNF\N-1-1-1:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>14</StartWord><!-
-WP-1-1-1-1:14-->

<WordInterval>0</WordInterval><!--WI-1-1-1-1:0-->

<StartFrame>1</StartFrame><!--FP-1-1-1-1:1-->

<FrameInterval>0</FrameInterval><!--FI-1-1-1-1:0-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-1-1-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                            <MeasurementLocation>
                                <!--MNF\N-1-1-2:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>39</StartWord><!-
-WP-1-1-1-1:39-->

<WordInterval>0</WordInterval><!--WI-1-1-1-1:0-->

<StartFrame>2</StartFrame><!--FP-1-1-1-1:2-->

<FrameInterval>0</FrameInterval><!--FI-1-1-1-1:0-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-1-2-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                        <Measurement Name="J951V"><!--MN-1-
2:J951V-->
                            <Parity>Default</Parity><!--MN1-1-
2:DE-->

<ParityTransferOrder>Default</ParityTransferOrder><!--MN2-1-2:D-
->
                            <MeasurementTransferOrder>LSB
First</MeasurementTransferOrder><!--MN3-1-2:L-->
                            <LocationType>Word and
Frame</LocationType><!--LT-1-2:WDFR-->
                            <!--MML\N-1-2:1 is implicit-->
                            <MeasurementLocation>
```

```
                                    <!--MNF\N-1-2-1:1 is implicit-->
                                    <MeasurementFragments>
                                        <StartWord>3</StartWord><!--
WP-1-2-1-1:3-->

<WordInterval>0</WordInterval><!--WI-1-2-1-1:0-->

<StartFrame>1</StartFrame><!--FP-1-2-1-1:1-->

<FrameInterval>0</FrameInterval><!--FI-1-2-1-1:0-->

<BitMask>1111111100000000</BitMask><!--WFM-1-2-1-
1:1111111100000000-->
                                    </MeasurementFragments>
                                </MeasurementLocation>
                            </Measurement>
                            <Measurement Name="J971U"><!--MN-1-
3:J971U-->
                                <Parity>Default</Parity><!--MN1-1-
3:DE-->

<ParityTransferOrder>Default</ParityTransferOrder><!--MN2-1-3:D-
->
                                <MeasurementTransferOrder>LSB
First</MeasurementTransferOrder><!--MN3-1-3:L-->
                                <LocationType>Word and
Frame</LocationType><!--LT-1-3:WDFR-->
                                <!--MML\N-1-3:6 is implicit-->
                                <MeasurementLocation>
                                    <!--MNF\N-1-3-1:1 is implicit-->
                                    <MeasurementFragments>
                                        <StartWord>2</StartWord><!--
WP-1-3-1-1:2-->

<WordInterval>0</WordInterval><!--WI-1-3-1-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-1-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-1-1:1-->
                                        <BitMask>Full
Word</BitMask><!--WFM-1-3-1-1:FW-->
                                    </MeasurementFragments>
                                </MeasurementLocation>
                                <MeasurementLocation>
                                    <!--MNF\N-1-3-2:1 is implicit-->
                                    <MeasurementFragments>
```

```
                                        <StartWord>11</StartWord><!-
-WP-1-3-2-1:11-->

<WordInterval>0</WordInterval><!--WI-1-3-2-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-2-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-2-1:1-->
                                        <BitMask>Full
Word</BitMask><!--WFM-1-3-2-1:FW-->
                                    </MeasurementFragments>
                                </MeasurementLocation>
                                <MeasurementLocation>
                                    <!--MNF\N-1-3-3:1 is implicit-->
                                    <MeasurementFragments>
                                        <StartWord>20</StartWord><!-
-WP-1-3-3-1:20-->

<WordInterval>0</WordInterval><!--WI-1-3-3-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-3-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-3-1:1-->
                                        <BitMask>Full
Word</BitMask><!--WFM-1-3-3-1:FW-->
                                    </MeasurementFragments>
                                </MeasurementLocation>
                                <MeasurementLocation>
                                    <!--MNF\N-1-3-4:1 is implicit-->
                                    <MeasurementFragments>
                                        <StartWord>29</StartWord><!-
-WP-1-3-4-1:29-->

<WordInterval>0</WordInterval><!--WI-1-3-4-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-4-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-4-1:1-->
                                        <BitMask>Full
Word</BitMask><!--WFM-1-3-4-1:FW-->
                                    </MeasurementFragments>
                                </MeasurementLocation>
                                <MeasurementLocation>
                                    <!--MNF\N-1-3-5:1 is implicit-->
                                    <MeasurementFragments>
                                        <StartWord>33</StartWord><!-
-WP-1-3-5-1:33-->
```

```
<WordInterval>0</WordInterval><!--WI-1-3-5-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-5-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-5-1:1-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-3-5-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                            <MeasurementLocation>
                                <!--MNF\N-1-3-6:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>47</StartWord><!-
-WP-1-3-6-1:47-->

<WordInterval>0</WordInterval><!--WI-1-3-6-1:0-->

<StartFrame>1</StartFrame><!--FP-1-3-6-1:1-->

<FrameInterval>1</FrameInterval><!--FI-1-3-6-1:1-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-3-6-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                        <Measurement Name="J966X"><!--MN-1-
4:J966X-->
                            <Parity>Default</Parity><!--MN1-1-
4:DE-->

<ParityTransferOrder>Default</ParityTransferOrder><!--MN2-1-4:D-
->
                            <MeasurementTransferOrder>LSB
First</MeasurementTransferOrder><!--MN3-1-4:L-->
                            <LocationType>Word and
Frame</LocationType><!--LT-1-4:WDFR-->
                            <!--MML\N-1-4:1 is implicit-->
                            <MeasurementLocation>
                                <!--MNF\N-1-4-1:1 is implicit-->
                                <MeasurementFragments>
                                    <StartWord>45</StartWord><!-
-WP-1-4-1-1:45-->

<WordInterval>0</WordInterval><!--WI-1-4-1-1:0-->

<StartFrame>3</StartFrame><!--FP-1-4-1-1:3-->
```

```
<FrameInterval>0</FrameInterval><!--FI-1-4-1-1:0-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-4-1-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                    </MeasurementList>
                </PCMMeasurements>
            </PCMFormatAttributes>

            <!-- C Group -->
            <DataConversionAttributes>
                <Measurement Name="J896D"><!--C-3\DCN:J896D-->
                    <Measurand>
                        <Description>Terrain
Altitude</Description><!--MN1:Terrain Altitude-->

<EngineeringUnits>FEET</EngineeringUnits><!--MN3:FEET-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Two's
Complement</BinaryFormat><!--BFM:TWO-->
                    </TelemetryValueDefinition>
                    <OtherInformation>
                        <MeasurementValue>
                            <Low>-32768.0</Low><!--MOT2:-32768--
>
                            <High>32768.0</High><!--MOT1:32768--
>
                        </MeasurementValue>
                    </OtherInformation>
                    <DataConversion Type="Pair Sets"><!--
DCT:PRS-->
                        <PairSets>
                            <!--PS\N:2 is implicit-->
                            <Application>Polynomial Curve
Fit</Application><!--PS1:Y-->
                            <OrderOfFit>1</OrderOfFit><!--PS2:1-
->
                            <Pair>
                                <TmValue>-32768</TmValue><!--
PS3-1:-32768-->
                                <EuValue>-32768.0</EuValue><!--
PS4-1:-32768-->
                            </Pair>
                            <Pair>
```

```
                                <TmValue>32767</TmValue><!--PS3-
2:32767-->
                                <EuValue>32767.0</EuValue><!--
PS4-2:32767-->
                            </Pair>
                        </PairSets>
                    </DataConversion>
                </Measurement>

                <Measurement Name="J951V"><!--C-4\DCN:J951V-->
                    <Measurand>
                        <Description>Throttle
Command</Description><!--MN1:Throttle Command-->

<EngineeringUnits>VDC</EngineeringUnits><!--MN3:VDC-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Two's
Complement</BinaryFormat><!--BFM:TWO-->
                    </TelemetryValueDefinition>
                    <OtherInformation>
                        <MeasurementValue>
                            <Low>-10.164</Low><!--MOT2:-10.164--
>
                            <High>10.164</High><!--MOT1:10.164--
>
                        </MeasurementValue>
                    </OtherInformation>
                    <DataConversion Type="Pair Sets"><!--
DCT:PRS-->
                        <PairSets>
                            <!--PS\N:2 is implicit-->
                            <Application>Polynomial Curve
Fit</Application><!--PS1:Y-->
                            <OrderOfFit>1</OrderOfFit><!--PS2:1-
->
                            <Pair>
                                <TmValue>-128</TmValue><!--PS3-
1:-128-->
                                <EuValue>-10.164</EuValue><!--
PS4-1:-10.164-->
                            </Pair>
                            <Pair>
                                <TmValue>127</TmValue><!--PS3-
2:127-->
                                <EuValue>10.164</EuValue><!--
PS4-2:10.164-->
```

```
                            </Pair>
                        </PairSets>
                    </DataConversion>
                </Measurement>

                <Measurement Name="J971U"><!--C-5\DCN:J971U-->
                    <Measurand>
                        <Description>DISC</Description><!--
MN1:DISC-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Unsigned
Binary</BinaryFormat><!--BFM:UNS-->
                    </TelemetryValueDefinition>
                    <DataConversion Type="Discrete"><!--DCT:DIS-
->
                        <!--what else goes here?-->
                    </DataConversion>
                </Measurement>

                <Measurement Name="J966X"><!--C-6\DCN:J966X-->
                    <Measurand>
                        <Description>Discrete</Description><!--
MN1:Discrete-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Unsigned
Binary</BinaryFormat><!--BFM:UNS-->
                    </TelemetryValueDefinition>
                    <DataConversion Type="Discrete"><!--DCT:DIS-
->
                        <!--what else goes here?-->
                    </DataConversion>
                </Measurement>

            </DataConversionAttributes>
        </DataLink>

    </DataSource>

    <PointOfContact>
        <Name>Orville</Name><!--POC1-2: Orville-->
        <Agency>Bikes,LTD</Agency><!--POC2-2:Bikes,LTD-->
        <Address>Dayton</Address><!--POC3-2: Dayton-->
        <Telephone>555-1212</Telephone><!--POC4-2: 555-1212-->
    </PointOfContact>
```

```
    <DataSource Name="Two PCM links - TM &amp; TSPI"
Type="Storage"><!--DSI-2:Two PCM links - TM & TSPI;DST-2:STO-->

        <!-- R Group -->
        <RecorderReproducerAttributes>
            <ID>Two PCM links - TM &amp; TSPI</ID><!--R-1\ID:Two
PCM links - TM & TSPI-->
            <Description>Recorded Data</Description><!--
R1:Recorded Data-->
            <Characteristics>
                <Type>Magnetic Disk</Type><!--TC1:MD-->

<NumberOfTracksOrChannels>2</NumberOfTracksOrChannels><!--N:2-->
            </Characteristics>
            <RecorderReproducerInfo>
                <Manufacturer>ZZ</Manufacturer><!--RI1:ZZ-->
                <Model>13</Model><!--RI2:13-->
                <OriginalRecording>Yes</OriginalRecording><!--
RI3:Y-->
                <OriginalRecordingDateAndTime>2011-07-
12T07:55:59</OriginalRecordingDateAndTime><!--RI4:07-12-2011-07-
55-59-->
                <CreatingOrganizationPointOfContact>
                    <Name>Mr. Tenn</Name><!--POC1:Mr. Tenn-->
                    <Agency>Data Creations</Agency><!--POC2:Data
Creations-->
                    <Address>Anywhere,Ttown</Address><!--
POC3:Anywhere,Ttown-->
                    <Telephone>555-1212</Telephone><!--POC4:555-
1212-->
                </CreatingOrganizationPointOfContact>
            </RecorderReproducerInfo>
            <Data>

<TrackNumberOrChannelID>2</TrackNumberOrChannelID><!--TK1-1:2-->
                <DataSourceID>PCM w/subframe
fragmented</DataSourceID><!--DSI-1:PCM w/subframe fragmented-->
                <ChannelDataType>PCM Input</ChannelDataType><!--
CDT-1:PCMIN-->

<ChannelDataLinkName>PCM1</ChannelDataLinkName><!--CDLN-1:PCM1--
>

<TrackNumberOrChannelID>4</TrackNumberOrChannelID><!--TK1-2:4-->
                <DataSourceID>Space Position
Information</DataSourceID><!--DSI-2:Space Position Information--
>
```

```
                <ChannelDataType>PCM Input</ChannelDataType><!--
CDT-2:PCMIN-->

<ChannelDataLinkName>SPI</ChannelDataLinkName><!--CDLN-2:SPI-->
            </Data>
        </RecorderReproducerAttributes>

    </DataSource>

            <DataLink Name="PCM1"><!--P-2\DLN:PCM1-->

            <!-- P Group -->
            <PCMFormatAttributes>
                <InputData>
                    <PCMCode>NRZ-L</PCMCode><!--D1:NRZ-L-->
                    <BitRate>2000000</BitRate><!--D2:2000000-->
                    <Encrypted>Unencrypted</Encrypted><!--D3:U--
>
                    <Polarity>Normal</Polarity><!--D4:N-->
                </InputData>
                <Format>
                    <TypeFormat>Class 1</TypeFormat><!--TF:ONE--
>
                    <CommonWordLength>10</CommonWordLength><!--
F1:10-->
                    <WordTransferOrder>MSB
First</WordTransferOrder><!--F2:M-->
                    <Parity>None</Parity><!--F3:NO-->
                    <MinorFrame>

<NumberOfMinorFrames>64</NumberOfMinorFrames><!--MF\N:64-->

<WordsPerMinorFrame>277</WordsPerMinorFrame><!--MF1:277-->
                        <!--MF4:30 is implicit-->

<SyncPattern>10111000000110011111010110101l</SyncPattern><!--
MF5:10111000000110011111010110101l-->
                    </MinorFrame>
                </Format>
                <SyncCriteria>
                    <InSync>
                        <Criteria>1</Criteria><!--SYNC1:1-->
                    </InSync>
                </SyncCriteria>
                <VariableWordLength>
                    <Word>121</Word><!--MFW1-1:121-->
                    <Length>6</Length><!--MFW2-1:6-->
```

```
                </VariableWordLength>
                <VariableWordLength>
                    <Word>122</Word><!--MFW1-2:122-->
                    <Length>4</Length><!--MFW2-2:4-->
                </VariableWordLength>
                <SubframeSynchronization>
                    <IDCounter><!--ISF\N:1 is implicit-->
                        <Name>1</Name><!--ISF1-1:1-->
                        <SyncType>ID Counter</SyncType><!--ISF2-
1:ID-->
                        <Location>13</Location><!--IDC1-1:13-->

<CounterStartingBitLocation>5</CounterStartingBitLocation><!--
IDC3-1:5-->
                        <CounterLength>6</CounterLength><!--
IDC4-1:6-->
                        <TransferOrder>MSB
First</TransferOrder><!--IDC5-1:M-->
                        <InitialValue>0</InitialValue><!--IDC6-
1:0-->

<InitialSubframeNumber>1</InitialSubframeNumber><!--IDC7-1:1-->
                        <EndValue>63</EndValue><!--IDC8-1:63-->

<EndSubframeNumber>64</EndSubframeNumber><!--IDC9-1:64-->

<CountDirection>Increasing</CountDirection><!--IDC10-1:INC-->
                    </IDCounter>
                </SubframeSynchronization>

                <!-- D Group -->
                <PCMMeasurements>
                <!--D-3\DLN:PCM1 is implicit-->
                    <MeasurementList Name="ONLY ONE"><!--MLN-
1:ONLY ONE-->
                        <!--MN\N-1:1 is implicit-->
                        <Measurement Name="82AJ01"><!--MN-1-
1:82AJ01-->
                            <LocationType>Word and
Frame</LocationType><!--LT-1-1:WDFR-->
                            <MeasurementLocation>
                                <MeasurementFragments>

<StartWord>113</StartWord><!--WP-1-1-1-1:113-->

<WordInterval>0</WordInterval><!--WI-1-1-1-1:0-->
```

```
<StartFrame>5</StartFrame><!--FP-1-1-1-1:5-->

<FrameInterval>32</FrameInterval><!--FI-1-1-1-1:32-->
                                    <BitMask>Full
Word</BitMask><!--WFM-1-1-1-1:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                            <MeasurementLocation>
                                <MeasurementFragments>

<StartWord>121</StartWord><!--WP-1-1-1-2:121-->

<WordInterval>0</WordInterval><!--WI-1-1-1-2:0-->

<StartFrame>5</StartFrame><!--FP-1-1-1-2:5-->

<FrameInterval>32</FrameInterval><!--FI-1-1-1-2:32-->
                                    <BitMask>FW</BitMask><!--
WFM-1-1-1-2:FW-->
                                </MeasurementFragments>
                            </MeasurementLocation>
                        </Measurement>
                    </MeasurementList>
                </PCMMeasurements>
            </PCMFormatAttributes>

            <!-- C Group -->
            <DataConversionAttributes>
                <Measurement Name="82AJ01"><!--C-7\DCN:82AJ01-->
                    <Measurand>
                        <Description>LANTZ Norm
acceleration</Description><!--MN1:LANTZ Norm acceleration-->

<EngineeringUnits>MTR/S/S</EngineeringUnits><!--MN3:MTR/S/S-->
                    </Measurand>
                    <TelemetryValueDefinition>
                        <BinaryFormat>Two's
Complement</BinaryFormat><!--BFM:TWO-->
                    </TelemetryValueDefinition>
                    <OtherInformation>
                        <MeasurementValue>
                            <Low>-1023.97</Low><!--MOT2:-
1023.97-->
                            <High>1023.97</High><!--
MOT1:1023.97-->
                        </MeasurementValue>
```

```
                    </OtherInformation>
                    <DataConversion Type="Coefficients"><!--
DCT:COE-->
                        <Coefficients>
                            <!--CO\N:1 is implicit-->

<DerivedFromPairSet>No</DerivedFromPairSet><!--CO1:N-->
                            <Coefficient
N="0">0</Coefficient><!--CO:0-->
                            <Coefficient
N="1">0.03125</Coefficient><!--CO-1:.03125-->
                        </Coefficients>
                    </DataConversion>
                </Measurement>
            </DataConversionAttributes>
        </DataLink>

            <DataLink Name="SPI"><!--P-4\DLN:SPI-->
            <!-- P Group -->
            <PCMFormatAttributes>
                <!-- D Group -->
                <PCMMeasurements>
                <!--D-4\DLN:SPI is implicit-->
                </PCMMeasurements>
            </PCMFormatAttributes>
        </DataLink>

    <Comment>I hope this flies.</Comment><!--COM: I hope this
flies.-->

</Tmats>
<!-- Last revised on: v3 2012/02/21 -->
```

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APPENDIX 9-D

Floating Point Formats

D.1. Introduction

Table D-1 provides a summary of floating point formats. Details of each format are shown on the pages following the table.

Table D-1. Floating Point Formats

Type	Size	Radix	Sign	Exponent	Fraction	Bias	Formula
IEEE_32	32	2	1	8	23	127	$(-1^S)(1.F)(2^{(E-127)})$
IEEE_64	64	2	1	11	52	1023	$(-1^S)(1.F)(2^{(E-1023)})$
1750A_32	32	2	0	8	24	0	$(0.F)(2^E)$
1750A_48	48	2	0	8	40	0	$(0.F)(2^E)$
DEC_32	32	2	1	8	23	128	$(-1^S)(0.1F)(2^{(E-128)})$
DEC_64	64	2	1	8	55	128	$(-1^S)(0.1F)(2^{(E-128)})$
DEC_64G	64	2	1	11	52	1024	$(-1^S)(0.1F)(2^{(E-1024)})$
IBM_32	32	16	1	7	24	64	$(-1^S)(0.F)(16^{(E-64)})$
IBM_64	64	16	1	7	56	64	$(-1^S)(0.F)(16^{(E-64)})$
TI_32	32	2	1	8	24	0	$((-2)^S + (0.F))(2^E)$
TI_40	40	2	1	8	32	0	$((-2)^S + (0.F))(2^E)$

D.2. IEEE 754 32-Bit Single Precision Floating Point

S	Exponent		Fraction	
1	2	9	10	32
			2^{-1}	2^{-23}

Value = $(-1^S)(1.F)(2^{(E-127)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 2 with bias of 127
Fraction = F portion of 23-bit fraction 1.F
0: E = 0, F = 0

D.3. IEEE 754 64-Bit Double Precision Floating Point

S	Exponent		Fraction	
1	2	12	13	64
			2^{-1}	2^{-52}

Value = $(-1^S)(1.F)(2^{(E-1023)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 2 with bias of 1023
Fraction = F portion of 52-bit fraction 1.F
0: E = 0, F = 0

D.4. MIL-STD-1750A 32-Bit Single Precision Floating Point

S	Fraction		Exponent	
1	2	24	25	32
	2^{-1}	2^{-23}		

Value = $(0.F)(2^{E})$

where Exponent = 2's complement power of 2
S = sign: 0 = Positive, 1 = Negative
S + Fraction = Normalized, 2's complement F portion of 24-bit fraction 0.F (Bit 2 MUST be set for positive, clear for negative)
0: F = 0

D.5. MIL-STD-1750A 48-Bit Double Precision Floating Point

S	Fraction (MSW)		Exponent		Fraction (LSW)	
1	2	24	25	32	33	48
	2^{-1}	2^{-23}			2^{-24}	2^{-31}

Value = $(0.F)(2^{E})$

where Exponent = 2's complement power of 2
S = sign: 0 = Positive, 1 = Negative
S + Fraction = Normalized, 2's complement F portion of 40-bit fraction 0.F (Bit 2 MUST be set for positive, clear for negative)
0: F = 0

D.6. DEC 32-Bit Single Precision Floating Point

S	Exponent		Fraction	
1	2	9	10	32
			2^{-2}	2^{-24}

Value = $(-1^{S})(0.1F)(2^{(E-128)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 2 with bias of 128
Fraction = F portion of 23-bit fraction 0.1F
0: S = 0 & F = 0 & E = 0

D.7. DEC 64-Bit Double Precision Floating Point

S	Exponent		Fraction	
1	2	9	10	64
			2^{-2}	2^{-56}

Value = $(-1^{S})(0.1F)(2^{(E-128)})$

where S = sign: 0 = Positive, 1 = Negative

Exponent = power of 2 with bias of 128
Fraction = F portion of 55-bit fraction 0.1F
0: S = 0 & F = 0 & E = 0

D.8. DEC 64-Bit "G" Double Precision Floating Point

S	Exponent		Fraction	
1	2	12	13	64
			2^{-2}	2^{-53}

Value = $(-1^{S})(0.1F)(2^{(E-1024)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 2 with bias of 1024
Fraction = F portion of 52-bit fraction 0.1F
0: S = 0 & F = 0 & E = 0

D.9. IBM 32-Bit Single Precision Floating Point

S	Exponent		Fraction	
1	2	8	9	32
			2^{-1}	2^{-24}

Value = $(-1^{S})(0.F)(16^{(E-64)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 16 with bias of 64
Fraction = Normalized F portion of 24-bit fraction 0.F (Bits 9-12 cannot be all zero)
0: F = 0

D.10. IBM 64-Bit Double Precision Floating Point

S	Exponent		Fraction	
1	2	8	9	64
			2^{-1}	2^{-56}

Value = $(-1^{S})(0.F)(16^{(E-64)})$

where S = sign: 0 = Positive, 1 = Negative
Exponent = power of 16 with bias of 64
Fraction = Normalized F portion of 56-bit fraction 0.F (Bits 9-12 cannot be all zero)
0: F = 0

D.11. TI (Texas Instruments) 32-Bit Single Precision Floating Point

Exponent		S	Fraction	
1	8	9	10	32
			2^{-1}	2^{-23}

Value = $((-2)^{S}+(0.F))(2^{E})$

where Exponent = 2's complement power of 2
S = sign: 0 = Positive, 1 = Negative
Fraction = 2's complement F portion of 24-bit fraction 1.F
0: E = −128

D.12. TI (Texas Instruments) 40-Bit Extended Precision Floating Point

Exponent		S	Fraction	
1	8	9	10	40
			2^{-1}	2^{-31}

Value = $((-2)^{S}+(0.F))(2^{E})$

where Exponent = 2's complement power of 2
S = sign: 0 = Positive, 1 = Negative
Fraction = 2's complement F portion of 32-bit fraction 1.F
0: E = −128

APPENDIX 9-E

Derived Parameter Specification

E.1. Derived Parameter Definition

Derived parameters are measurements that do not appear in any data stream; instead, they are calculated from telemetry measurements in a data stream, numeric constants, and/or other derived measurements. In a Telemetry Attributes Transfer Standard (TMATS) file, derived measurements will only have entries in the C group; the other TMATS groups containing measurement names that link to C group entries only include telemetry measurements.

Derived parameters are defined using the Algorithm Type (C-d\DPAT) and Algorithm (C-d\DPA) attributes in the Derived Parameter section of the TMATS C group. They can be defined in one of two methods. The first method to specify the name of an algorithm ("function style") and the second method is to specify a text string of the algorithm itself ("formula style"). Both of these methods are currently used in telemetry processing systems.

In function style, Algorithm Type is set to "N" and Algorithm contains the name of a function, which will be one of the mathematical functions or operators as defined in the derived algorithm grammar shown in this appendix. The Input Measurand attributes (C-d\DP\N and C-d\DP-n) and Input Constant attributes (C-d\DPC\N and C-d\DPC-n) are used to specify the arguments needed by the named function (measurements and numeric constants, respectively, as defined in the derived algorithm grammar in this appendix). The Trigger Measurand and Number of Occurrences attributes are used to specify when and how often the derived parameter will be calculated.

In formula style, Algorithm Type is set to "A" and Algorithm contains the actual function, given according to the derived algorithm grammar defined in this appendix. The Input Measurand attributes and Input Constant attributes are not used. The Trigger Measurand and Number of Occurrences attributes are used to specify when and how often the derived parameter will be calculated.

E.2. Derived Algorithm Grammar: Components

Derived algorithm grammar is from the four components listed below. The derived algorithm may be any combination of operators, functions, measurements, and numeric constants strung together using the guidelines in this document to create complex mathematical expressions (see Subsection E.6.b). Sample syntaxes for the Yet Another Compiler Compiler (Yacc) grammar and Lexicon (Lex) grammar are provided in Section E.8.

a. Operators (Section E.3)

b. Numeric Constants (Section E.4)

c. Measurements (Section E.5)

d. Mathematical Functions (Section E.6).

E.3. Operators

Operators are simply mathematical functions that have a special syntax in the grammar. They have operator symbol(s) that have well-defined arguments and return a value as a result. Logical operators are merely functions that return a value of 0 and non-zero for false and true respectively.

E.3.a. Arithmetic Operators

Table E-1. Arithmetic Operators

Operator	Description	Example
+	Addition (Sum)	A + B
-	Subtraction (Difference)	A – B
*	Multiplication (Product)	A * B
/	Division (Quotient)	A / B
%	Modulus (Remainder)	A % B
**	Exponentiation	A ** B

E.3.b. Bit Manipulation Operators

Table E-2. Bit Manipulation Operators

Operator	Description	Example
|	Bit-wise OR	A | B
&	Bit-wise AND	A & B
^	Bit-wise XOR	A ^ B
~	Bit-wise NOT	~A
<<	Bit-wise Left Shift	A << B
>>	Bit-wise Right Shift	A >> B

E.3.c. Relational Operators

Table E-3. Relational Operators

Operator	Description	Example
= =	Equal To	A = = B
!=	Not Equal To	A != B
<=	Less Than or Equal To	A <= B
>=	Greater Than or Equal To	A >= B
<	Less Than	A < B
>	Greater Than	A > B
||	Logical OR	A || B
&&	Logical AND	A && B
!	Logical NOT (Negation)	!A

E.3.d. Ternary (if then else) Operator

Table E-4. Ternary (if then else) Operator		
Operator	**Description**	**Example**
?:	Ternary Operator (if-then-else)	A ? B : C

E.3.e. Associativity Operator

Table E-5. Associativity Operator		
Operator	**Description**	**Example**
( )	Associativity	(A + B) * C

E.3.f. Precedence and Associativity of Operators From Highest to Lowest

Table E-6. Precedence and Associativity of Operators from Highest to Lowest	
Operators	**Associativity**
( )	Left to right
-(UNARY)	Right to left
! ~	Right to left
**	Left to right
&	Left to right
^	Left to right
|	Left to right
* / %	Left to right
+ -	Left to right
<< >>	Left to right
< > <= >=	Left to right
= = !=	Left to right
&&	Left to right
||	Left to right
?:	Right to left
,	Left to right

E.4. Numeric Constants

Numeric constants are simply numbers used in the calculations.

Table E-7 Numeric Constants (Examples)	
Description	**Examples**
Any string of characters that contains only numerals	1234 0
Any string of characters that contains only numerals and a-f preceded by "0x" (hex)	0x12ab 0x1

Any string of characters that contains only numerals and a single ".".	1.2 1. .2
Any string of characters that contains only numerals, in scientific notation.	1.0E+10 10E−10 .1e6
Note: As in the TMATS standard itself, alphanumeric data items are case insensitive; either upper or lower case characters are allowed.	

E.5. Measurements

Measurements may be telemetry measurements or other derived measurements.

Table E-8. Measurements (Examples)

Description	Examples
Any string of characters beginning with an alphabetic character and containing only alphanumerics and "$_"	A00.1 A$1
Any string of characters that is quoted with " and does not contain ".	"0001" “measurement ’quoted’, though this is insane - it is legal”
Any string of characters quoted with ' and does not contain '.	'Air Speed'
Any string of characters that contains only numerals and at least one alphabetic character. This differs from hex because it does not begin with “0x”.	00A1 0X (this is ok, because it does not have a number after “0X”)
Note: As in the TMATS standard itself, alphanumeric data items are case insensitive; either upper or lower case characters are allowed.	

E.6. Mathematical Functions

E.6.a. Mathematical Function Format

Mathematical functions are numerical functions that take some input, perform a specific calculation, and return a value as the result. Each mathematical function has the form “name(arg1,arg2,...)” that identifies a well-defined name and contains argument(s) that are separated by commas and surrounded by parentheses. A list of selected mathematical functions is provided in Table E-9.

E.6.b. Complex Use of Functions

Examples of how functions can be used in mathematical expressions are:

e. A*(SIN(B/C)+D)
f. A*3.0
g. "0001"*A+~B
h. A<B || B<<C ? D : E

Table E-9. Table of Selected Mathematical Functions

Name	Description
acos(x)	$\cos^{-1}(x)$ in range $[0,\pi]$, x Є $[-1,1]$.
asin(x)	$\sin^{-1}(x)$ in range $[-\pi/2, \pi/2]$, x Є $[-1,1]$.
atan(x)	$\tan^{-1}(x)$ in range $[-\pi/2, \pi/2]$
atan2(y,x)	$\tan^{-1}(y/x)$ in range $[-\pi, \pi]$
ceil(x)	smallest integer not less than x
cos(x)	cosine of x
cosh(x)	hyperbolic cosine of x
exp(x)	exponential function, computes ex
fabs(x)	absolute value |x|
floor(x)	largest integer not greater than x
fmod(x)	floating point remainder
frexpx(d)	Find x in [.5,1] and y so that d = x*pow(2,y), return x
frexpy(d)	Find x in [.5,1] and y so that d = x*pow(2,y), return y
ldexp(d,i)	returns d*pow(2,i)
log(x)	natural logarithm ln(x), x > 0
log10(x)	base-10 logarithm log10(x), x > 0
max(x,y)	if x>y, then return x, else return y
min(x,y)	if x<y, then return x, else return y
modfd(d)	returns integral part of d
modfp(d)	returns fractional part of d
pow(x,y)	compute a value taken to an exponent, xy. An error occurs when x<=0 and y <= 0 or x < 0 and y is not an integer
sin(x)	sine of x
sinh(x)	hyperbolic sine of x
sqrt(x)	square root √x, x>= 0
tan(x)	tangent of x
tanh(x)	hyperbolic tangent of x

E.7. Derived Grammar Syntax Overview

The following grammar, strictly speaking, does not match the C language. Although loosely based on C, the grammar attempts to follow the "spirit" of the C language. The grammar contains three terminal symbols (MEASUREMENT, NUMERIC_CONSTANT, and FUNCTION_NAME) not defined here, but easily understood by their names. The grammar contains two non-terminals, expression and expression-list, which define the entire grammar. The "|" operator used in the grammar denotes a choice meaning "this or that or …" Quoted strings are literal tokens of the grammar.

```
expression:
        expression '+' expression
        | expression '-' expression
        | expression '*' expression
        | expression '/'  expression
        | expression '|' expression
        | expression '&' expression
        | expression '%' expression
        | expression '**' expression
        | expression '?' expression ':' expression
        | expression '<' expression
        | expression '>' expression
        | expression '<=' expression
        | expression '>=' expression
        | expression '!=' expression
        | expression '==' expression
        | expression '&&' expression
        | expression '||' expression
        | '-' expression
        | '!' expression
        | '~' expression
        | ' (' expression ') '
        | MEASUREMENT
        | NUMERIC_CONSTANT
        | FUNCTION_NAME '(' expression_list ')'
        | FUNCTION_NAME ' (' ')'

        expression-list:
        expression
        | expression-list ',' expression
```

Figure E-1. Grammar Syntax

E.8. Grammar Examples

Examples of Yacc and Lex grammar are shown in Figure E-2 and Figure E-3, respectively. The grammar will recognize the derived syntax; that is, they will report whether or not a given text string is valid syntax; however, the examples are not intended to be complete; in other words, they will not compile or perform the calculation. The user needs only to build a program around them in order to use them; a simple example “main” is shown in Figure E-4.

The Yacc is a parser generator developed by Stephen C. Johnson at American Telephone and Telegraph (AT&T) for the Unix operating system. It generates a parser, in C language code, based on an analytic grammar written in a notation similar to Backus-Naur Form (BNF). The Lex, a program that generates lexical analyzers, is commonly used along with the Yacc parser generator. Originally written by Eric Schmidt and Mike Lesk, Lex is the standard lexical

analyzer generator on many Unix systems. A tool exhibiting its behavior is specified as part of the Portable Operating System Interface standard.

```
%{

%}

%token ERR
%token NAME
%token CONSTANT

// Operator Precedence Rules (Lowest First, Highest Last)

%left ','
%right COND '?'
%left OR
%left AND
%left EQUAL NOTEQUAL
%left '<' '>' LESSEQUAL GREATEREQUAL
%left LSHIFT RSHIFT
%left '-' '+'
%left '*' '/' '%'
%left '|'
%left '^'
%left '&'
%left POWER
%right '!' '~'
%right UMINUS

// Definition of Rules

%%
expression:
        expression '+' expression
        | expression '-' expression
        | expression '*' expression
        | expression '^' expression
        | expression '&' expression
        | expression '%' expression
        | expression LSHIFT expression
        | expression RSHIFT expression
        | expression POWER expression
        | expression '?' expression ':' expression %prec COND
```

Figure E-2. Yacc Grammar Example, Page 1 of 2

```
        | '-' expression %prec UMINUS
        | '!' expression
        | '~' expression
        | '(' expression ')'
        | NAME
        | CONSTANT
        | NAME '(' expression_list ')'
        | NAME '(' ')'
        | expression '<' expression
        | expression '>' expression
        | expression LESSEQUAL expression
        | expression GREATEREQUAL expression
        | expression NOTEQUAL expression
        | expression EQUAL expression
        | expression OR expression
        | expression AND expression
        ;

expression_list:
        expression
        | expression_list ',' expression
        ;


%%
```

Figure E-3. Yacc Grammar Example, Page 2 of 2

```
%{
#include “y.tab.h”
%}

%%

[\t\n ]                 {}

\=\=                    { return(EQUAL); }              // Equal To
\!\=                    { return(NOTEQUAL); }                   // Not Equal To
\<\=                    { return(LESSEQUAL); }                  // Less Than or Equal To
\>\=                    { return(GREATEREQUAL); }       // Greater Than or Equal To
(\*\*)                  { return(POWER); }              // Power (FORTRANish)
\|\|                    { return(OR); }                         // Logical OR
\&\&                    { return(AND); }                // Logical AND
\<\<                    { return(LSHIFT); }             // Bitwise Left Shift
\>\>                    { return(RSHIFT); }             // Bitwise Right Shift

\>                      |                               // Greater Than
\<                      |                               // Less Than
\!                      |                               // Logical Negation
\?                      |                               // Ternary Operator ?
\:                      |                               // Ternary Operator :
\%                      |                               // Modulus (Remainder)
\,                      |                               // Comma Operator (function)
\*                      |                               // Multiplication (Product)
\/                      |                               // Division (Quotient)
\+                      |                               // Addition (Sum)
\−                      |                               // Subtraction (Difference)
\|                      |                               // Bitwise OR
\&                      |                               // Bitwise AND
\^                      |                               // Bitwise XOR
\~                      |                               // Bitwise NOT
\(                      |
\)                      { return(yytext[0]); }
```

Figure E-4. Lex Grammar Example, Page 1 of 2

```
([0][xX][0-9a-fA-F]+)|([0-9]+)                          {
                                        return(CONSTANT);
                }

(([0-9]+\.?[0-9]*)|([0-9]*\.[0-9]+))([eE][-+]?[0-9]+)? {
                                        return(CONSTANT);
                }

\"[^\"\n]*\"            |
\'[^'\n]*\'             {
                                        return(NAME);
                        }
([0-9]+[a-zA-Z])?[a-zA-Z0-9$_\.]+   {
                                        return(NAME);
                        }


.                       { return(ERR); }            // Catchall Error

%%
```

Figure E-5. Lex Grammar, Page 2 of 2

```
yywrap()
{
  return 1;
}
yyerror(char *s)
{
  printf("error: %s\n",s);
}
main()
{
  yyparse();
}
```

Figure E-6. Example Program (Main)

E.9. Telemetry Attributes Transfer Standard (TMATS) Examples

In the following examples, input measurement names are in the form of MA, MB, and MC. Derived parameter names are in the form of DMA, DMB, and DMC.

E.9.a. TMATS Example 1

DMA = MA + MB

Function style

C-1\DCN:DMA;	Derived parameter
C-1\DCT:DER;	Derived conversion type
C-1\DPAT:N;	Name of algorithm will be given
C-1\DPA:+;	Addition operator
C-1\DPTM:MB;	Measurement MB triggers the calculation
C-1\DPNO:1;	Every sample of MB triggers the calculation
C-1\DP\N:2;	Two input measurements
C-1\DP-1:MA;	
C-1\DP-2:MB;	

Formula style

C-2\DCN:DMA;	
C-2\DCT:DER;	
C-2\DPAT:A;	Algorithm will be given
C-2\DPA:MA + MB;	Algorithm syntax
C-2\DPTM:MB;	
C-2\DPNO:1;	

E.9.b. TMATS Example 2

DMB = MC / MD

Function style

C-3\DCN:DMB;	Derived parameter
C-3\DCT:DER;	Derived conversion type
C-3\DPAT:N;	Name of algorithm will be given
C-3\DPA:/;	Division operator
C-3\DPTM:MD;	Measurement MD triggers the calculation
C-3\DPNO:1;	Every sample of MD triggers the calculation
C-3\DP\N:2;	Two input measurements
C-3\DP-1:MC;	
C-3\DP-2:MD;	

Note: In function style, the algorithm determines the meaning of the input measurements. In this example, the division algorithm assigns the first input measurement as the dividend and the second input measurement as the divisor.

Formula style

C-4\DCN:DMB;
C-4\DCT:DER;
C-4\DPAT:A; Algorithm will be given
C-4\DPA:MC / MD; Algorithm syntax
C-4\DPTM:MD;
C-4\DPNO:1;

E.9.c. TMATS Example 3

DMC = square root of ME

Function style

C-5\DCN:DMC; Derived parameter
C-5\DCT:DER; Derived conversion type
C-5\DPAT:N; Name of algorithm will be given
C-5\DPA:SQRT; Square root function
C-5\DP\N:1; One input measurement
C-5\DP-1:ME;

Formula style

C-6\DCN :DMC;
C-6\DCT :DER;
C-6\DPAT:A; Algorithm will be given
C-6\DPA:SQRT(ME); Algorithm syntax

Note: The trigger measurand is not given; there is only one input, which must trigger the calculation.

E.9.d. TMATS Example 4

DMD = MF*(SIN(MG/MH)+MJ)

Function style

C-7\DCN:XA; Derived parameter
C-7\DCT:DER; Derived conversion type
C-7\DPAT:N; Name of algorithm will be given
C-7\DPA:/; Division operator
C-7\DP\N:2; Two input measurements
C-7\DP-1:MG;
C-7\DP-2:MH;
C-8\DCN:XB; Derived parameter
C-8\DCT:DER; Derived conversion type
C-8\DPAT:N; Name of algorithm will be given

```
C-8\DPA:SIN;              Sine function
C-8\DP\N:1;               One input measurement
C-8\DP-1:XA;
C-9\DCN:XC;               Derived parameter
C-9\DCT:DER;              Derived conversion type
C-9\DPAT:N;               Name of algorithm will be given
C-9\DPA:+;                Addition operator
C-9\DP\N:2;               Two input measurements
C-9\DP-1:XB;
C-9\DP-2:MJ;
C-10\DCN:DMD;             Derived parameter
C-10\DCT:DER;             Derived conversion type
C-10\DPAT:N;              Name of algorithm will be given
C-10\DPA:*;               Multiplication operator
C-10\DP\N:2;              Two input measurements
C-10\DP-1:MF;
C-10\DP-2:XC;
```

Note: In this example, several steps are needed, each generating an intermediate result (XA, XB, and XC), before the derived parameter is obtained. This method is shown only for illustrative purposes and is not recommended. If this function is needed, a custom algorithm should be written to implement it. Then the function style could be used, as follows:

```
C-11\DCN:DMD;             Derived parameter
C-11\DCT:DER;             Derived conversion type
C-11\DPAT:N;              Name of algorithm will be given
C-11\DPA:NEWALG;          Name of custom algorithm
C-11\DPTM:MJ;
C-11\DPNO:1;
C-11\DP\N:4;              Four input measurements
C-11\DP-1:MF;
C-11\DP-2:MG;
C-11\DP-3:MH;
C-11\DP-4:MJ;
```

Formula style

```
C-12\DCN:DMD;
C-12\DCT:DER;
C-12\DPAT:A;              Algorithm will be given
C-12\DPA:MF*(SIN(MG/MH)+MJ);
C-12\DPTM:MJ;
C-12\DPNO:1;
```

E.10. Glossary of Terms

Backus-Naur Form: A metasyntax used to express context-free grammar; that is, a formal way to describe formal languages. John Backus and Peter Naur developed a context free grammar to define the syntax of a programming language by using two sets of rules: i.e., lexical rules and syntactic rules

Compiler: A computer program (or set of programs) that transforms source code written in a computer language (the source language) into another computer language (the target language, often having a binary form known as object code).

Compiler (Compiler Generator): A tool that creates a parser, interpreter, or compiler from some form of formal description. The earliest and still most common form of compiler-compiler is a parser generator, whose input is a grammar (usually in BNF) of a programming language, and whose generated output is the source code of a parser.

Computer Programs: Also called software programs, or just programs, are instructions for a computer.

Grammar: A set of formation rules that describe which strings formed from the alphabet of a formal language are syntactically valid within the language.

Interpreter: Normally means a computer program that executes instructions written in a programming language.

Parser Generator: See Compiler.

Parsing: The process of analyzing a sequence of tokens (for example, words) to determine their grammatical structure with respect to a given (more or less) formal grammar.

Programming Language: A machine-readable artificial language designed to express computations that can be performed by a machine, particularly a computer.

Source Code: Any collection of statements or declarations written in some human-readable computer programming language.

Unix: A computer operating system originally developed in 1969 by a group of AT&T employees at Bell Labs.

Yet Another: In hacker jargon, the use of yet another as a way of padding out an acronym is fairly common. It was first used by Stephen C. Johnson in the late 1970s in naming Yacc as a humorous reference to the proliferation of such compiler-compilers at the time.

Yet Another Compiler Compiler (Yacc): Supplied with Unix and Unix-like systems.

APPENDIX 9-F

Citations

Range Commanders Council. "IRIG Serial Time Code Formats." RCC 200-04. May be superseded by update. Retrieved 4 June 2015. Available at http://www.wsmr.army.mil/RCCsite/Documents/200-04_IRIG_Serial_Time_Code_Formats/.

****** END OF CHAPTER 9 ******